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THE ELEMENTS

OF

PHYSICAL EDUCATION

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A TEACHER'S MANUAL

BY

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WITH ORIGINAL MUSICAL ACCOMPANIMENTS TO THE DRILL

BY

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PREFACE.

THIS little book is intended for teachers.

In the First Part an endeavour has been made to compile, in a very brief but fairly exhaustive manner, the essentials of all that is known with regard to the physiology and psychology of muscular exercise, without entering into such details as can only be understood by specialists. One of the chief objects of this theoretical introduction is to indicate the relations of muscle and mind, and, thereby, show that properly conducted physical exercise is not merely a means of "getting up" the muscles, but also a means of educating much higher faculties. Although the information in those pages is in a sense technical, it is presented as far as possible in a popular style. Especial consideration has been given to the wants of school teachers who are preparing for the certificate in Physical Instruction of the Education Department, but it is hoped that the work may be of use to all who take an intelligent interest in physical training. It may therefore be of service to army and navy officers, superintendents of institutions for the feeble-minded, and governors of criminal establishments.

In the Second Part illustrations are given of the principles laid down. The drills are arranged in a consecutive and progressive series, so that a teacher may be saved the trouble of devising a practical order of instruction. Every effort has been made to describe each step so clearly, that any one not previously versed in physical drill will have no difficulty in understanding the movements. Only exercises suitable for a classroom without fixed apparatus are included. They may, therefore, be used in a school or institution not possessing a gymnasium. Both sexes may with equal advantage practise them. Many of the exercises are original. The selection given is the result of over twenty-five years' experience in physical education. It meets the requirements of the Code of the Education Department. And it is in daily use in Dundee Public Gymnasium, which is one of the officially recognised centres for the physical instruction of school teachers by the Scotch Education Department.

For the continuation of the various musical numbers contained in the book, application should be made to Mr H. E. Loseby, Her Majesty's Theatre, Dundee.

The authors are indebted to Mr T. D. Dunn, Art Master in the Technical Institute, Dundee, for the anatomical and other illustrations; to Messrs Valentine & Co. for the photographs of the various positions of drill; and to Messrs J. Macpherson, Instructor at Dundee Gymnasium, and G. G. Rodger, M.A., B.Sc., Champion Gymnast of Scotland, for much valuable assistance.

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PART I.

THE PHYSIOLOGY AND PSYCHOLOGY OF MUSCULAR EXERCISE

BY

DAVID LENNOX, M.D.

THE PHYSIOLOGY AND PSYCHOLOGY OF MUSCULAR EXERCISE.

Not many years ago an athlete was popularly regarded as a human animal with the maximum of muscle and the minimum of mind. Even learned instructors of youth leant to this view. They did, indeed, admit that muscular activity was more or less essential to bodily health, and they recognised the obvious utility of strength in those who were to be hewers of wood and drawers of water. But, having thus far acknowledged the benefit of physical culture, they dismissed such exercises as having no educational value and being altogether outside the pale of professional tuition. With them and others it was quite an orthodox illustration to contrast muscles with brains, and to express surprise at intellectual strength in the physically strong. Sometimes even the natural desire for muscular exercise in the young was looked upon as a necessary evil, due to superabundant animal spirits—an unavoidable lapse from scholastic habits of mind which was compassionately excused on the ground

that the bow could not be always strained to higher duties. Boys would be boys. Therefore, being in the main incorrigible, they were permitted to play when they could without any further supervision than that entailed in preventing them from accident and in safeguarding the property of her Majesty's lieges. But in every well-regulated seminary for young ladies the proper amount of physical exercise consisted in a staid perambulation of unfrequented streets, with, in very advanced schools, occasional calisthenic drills, which under no circumstances, we were assured, could develop any approach to masculine muscularity and coarseness.

These worthy preceptors of youth were almost ignorant of the physiological and psychological effects of exercise. They scarcely understood that without muscular tissue we cannot have our intellectual being; and they probably never knew that in muscular activity they had an educational means of the greatest value in securing the health, discipline, and development not only of the muscles but also of the brain. For many of our sense perceptions depend on our experience of muscular movements, many of our intellectual possibilities are due to those perceptions, and many of our mental and moral habits are the result of definitely associating particular muscular efforts with certain sensations and ideas.

Of late years, however, a vast revolution has overtaken society so far as regards purely physical culture. Almost every one is encouraged to engage in exercise. Even at the most strict boarding-schools for young ladies, one may see girls playing at cricket, football, and other manly sports. The most effeminate of our women bicycle. And

the stronger sex largely crowd to athletic contests. Perhaps, indeed, there is now an excess of exercise. Certainly much of it is misdirected and detrimental. There is quantity enough but not quality in present-day physical culture. Few of the popular forms of sport are to be recommended from an educational point of view; few, if any, of them give employment to more than a small part of the body; and most of them cannot be undertaken with unfailing regularity. It is not in the excessive development of certain groups of muscles or the proficiency in a given feat of strength that physical training consists, but in a general excellence of every department of the muscular system, so as to attain a perfect relation of the muscles to the functions of organic life, and to the activity and discipline of the brain.

In other words, exercise for each individual should be laid down on strictly reasoned lines. This implies on the part of the instructor a more or less intimate acquaintance with the physiology and psychology of exercise, as well as a fairly accurate notion of the functions of the body generally. Physical exercise, like painting, should be done with brains.

To thus understand the construction and activities of the human body, in so far as they are concerned with muscular movements under the influence of the will, it may be helpful to approach the subject from a developmental point of view.

At first the highest of animals consists simply of an egg or cell. This single egg splits into two cells, which subdivide again to form four, and those continue to split up in geometrical progression, the four becoming eight,

the eight sixteen, the sixteen thirty-two, and so on until the single cell has developed into an innumerable mass of cells like its original self.

Eventually these cells undergo modifications, and are arranged in the form of a tube or cylinder which encloses two smaller tubes with a cellular packing around them. The outer tube or casing is the body wall, while the enclosed tubes constitute the alimentary or food canal and the great nervous tube or spinal cord. Shortly after this a horizontal partition of flesh called the midriff or diaphragm divides the body cylinder into an upper and lower compartment, which are respectively known as the chest or thorax and the belly or abdomen. The former holds the heart and lungs, and the latter the stomach, liver, kidneys, and intestines.

By this time the two enclosed tubes have developed. The upper part of the posterior one bulges out into the brain. And the middle of the central or food canal expands into a pear-shaped cavity known as the stomach. Other sacs grow from the sides of the food canal. At the upper or mouth end sacs develop for the secretion of saliva. A little lower down two sacs expand into the lungs. And below the stomach other recesses form the liver and pancreas.

To support the body thus formed, a framework or skeleton is required. Consequently a bony column grows around the spinal cord protecting the delicate structure within, and the enlarged end of the cord, or brain, is covered by an expansion of bone known as the skull. From the spinal column of bone other bones—the ribs—stretch out circumferentially to support the outer cylinder

or body wall. Buds are meanwhile given off by the trunk to form the limbs. In man the extremities are moulded on so similar a plan that comparatively trivial differences are to be found between the bones of the upper and lower limbs. Yet those slight divergencies are distinctive of his erect posture.

Bone consists of mineral and animal matter, in the proportion of two to one, with a variable amount of water. The mineral matter is so intimately connected with the animal as to be invisible on microscopic examination. Even if a long bone such as the collar-bone is burned, and all the animal matter consumed, the ash retains the form of the original bone, but is excessively brittle. And if a similar bone is steeped in a mixture of one part of hydrochloric acid and five parts of water, the salts are dissolved out, leaving an organic framework identical in shape with the original bone, yet so pliable that it may be tied into a knot. To this animal basis the toughness and elasticity of bone are due, enabling it to resist fracture —a quality often observed in the merry-thought of a fowl, and curiously used by Arab children, who make bows out of ribs. To the earthy matter the solidity of bone is accountable, enabling it to support weight and resist pressure in all directions. There is no increase in the proportion of mineral to organic matter with the increase of age. Any additional liability to broken bones in old people depends on a molecular change, and not on a larger quantity of salts. The chief salts present in bone are four compounds of lime and one of magnesium. Ninety-seven per cent of them are phosphates and carbonates of lime.

Externally bone is very hard and solid, but the interior is either hollow or spongy or partly both. The hollow shaft secures lightness without loss of strength, for strength largely depends on the extent of circumference. And the spongy construction gives it a greater capacity for resisting strains. Bone is twice as strong as oak.

In the human body there are two hundred bones. These, according to their shape, are classified into long, short, flat, and irregular bones. Long cylindrical bones acting as levers are adapted for extensive motion, whereas short square bones are suited for limited movements requiring great strength.

The Backbone or Spine is the foundation or keel of the entire skeleton (*vide* fig. 1, p. 10). To it all the other bones are directly or indirectly attached. It consists not of one backbone but of twenty-four backbones or vertebræ, which are piled like coins one on the top of the other, with an elastic pad between, and rest on a wedge-shaped mass of bone known as the sacrum. Like Chinese coins, the backbones have a hole in the centre. Through this the spinal cord runs. The uppermost seven bones are known as the Cervical or neck vertebræ, the middle twelve as the Dorsal vertebræ, and the five lowest as the Lumbar or loin vertebræ.

The Sacrum, with its apex pointing downwards, is made up of five vertebræ fused together, and is curved concave anteriorly. To its tip hangs the rudimentary tail possessed by man to remind him of the origin of his species.

The spinal column is not straight, but has certain curves in its plane from front to back. At the time of an infant's birth, and so long as it creeps on its hands and knees, the

spine has only two curves, and is in that respect similar to the backbone of four-footed animals. One large curve with its concavity directed forwards extends from the upper end of the neck to the last of the twenty-four true vertebræ. Another and smaller one, also with its concavity to the front, is present in the sacrum and its appendix, the coccyx. This latter curve persists throughout life. When the child begins to assume its distinctively human attitude, the muscles of the back erect the spine, and their action preponderating in the dorsal region, increase the original convexity backwards. But in the lumbar region the muscular forces which pull in front are stronger than those behind, and bend the flexible column into a convexity forwards at the hollow of the back. And in the neck another curve with its convexity to the front is produced by muscular action, even before the erect position is fully developed, so that the curves correct each other. Thus the necessity for supporting the body in a central line is secured. These curves are the result of the erect attitude, and are therefore secondary in their production. When, however, an adult is kept in a horizontal position for a considerable period, the curves become less marked and the spine is consequently longer. So that a patient after a protracted illness is visibly taller. Indeed every one is of greater stature in the morning than when he went to bed the night before—a circumstance often taken advantage of by smart recruiting sergeants.

On the topmost bone of the spine is perched the skull, which consists of twenty-two bones all immovably jointed together except one bone—the lower jaw—which moves

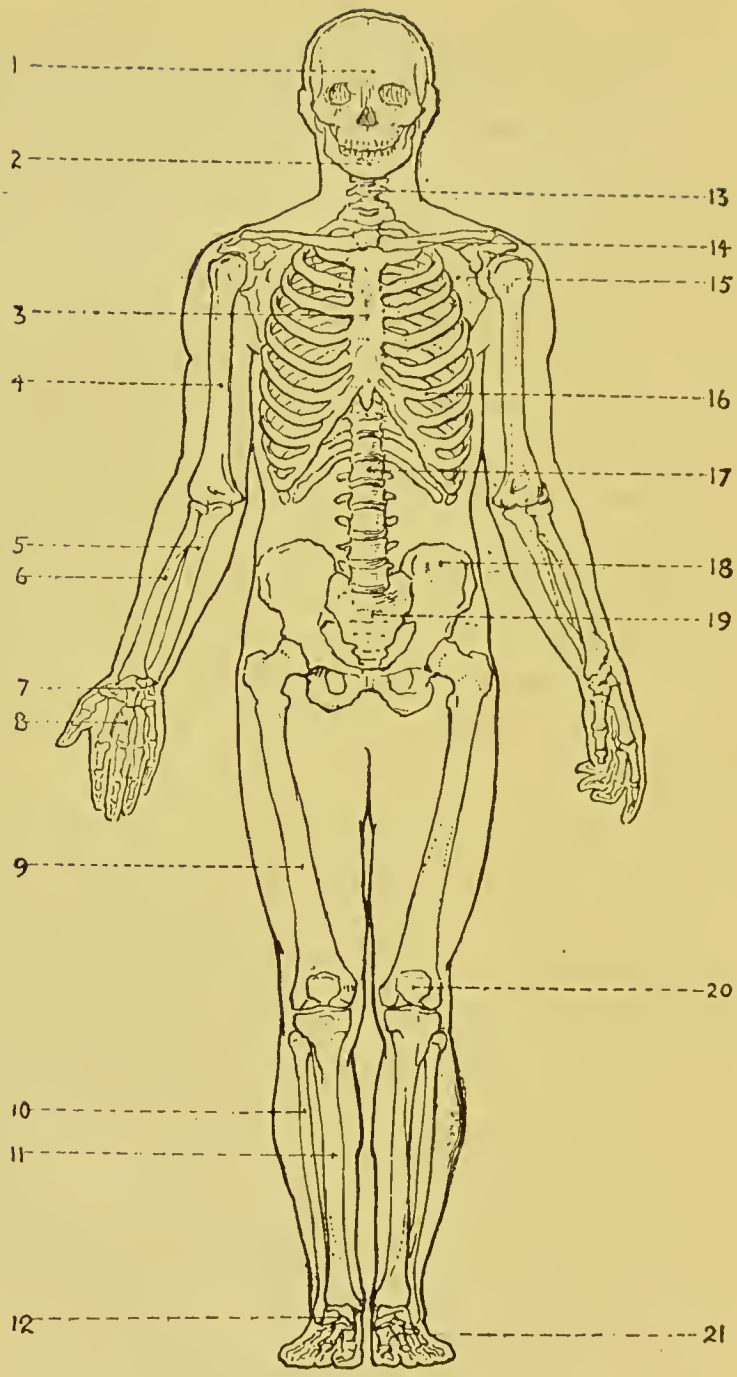

Fig. 1.

FIG. 1.

1. Cranium or skull-cap.
2. Lower jaw.
3. Sternum or breast-bone.
4. Humerus.
5. Ulna.
6. Radius.
7. Carpus or wrist-bones.
8. Metacarpal bones, or bones of palm of hand.
9. Femur or thigh-bone.
10. Fibula or splint-bone.
11. Tibia or shin-bone.
12. Tarsus or ankle-bones.
13. Cervical or neck vertebræ.
14. Clavicle or collar-bone.
15. Scapula or shoulder-blade.
16. Ribs.
17. Lumbar or loin vertebræ.
18. Innominate or haunch-bone
19. Sacrum.
20. Patella or knee-cap.
21. Metatarsal bones.

freely, perhaps somewhat too freely at times. Eight of the bones of the skull form a box or brain-case known as the Cranium. The others constitute the skeleton of the face, and enclose the cavities of the orbits, nose, and mouth.

Attached to either side of the twelve dorsal vertebræ are pairs of ribs, twenty-four bones, which form hoops like those of a barrel to support the body wall. Whatever may have been the case in the Garden of Eden, modern Eves and modern Adams have precisely the same number of ribs. The seven upper pairs, increasing in length from above downwards, are fixed in front to the breast-bone and are known as the True ribs. The lower five pairs, or False ribs, decrease in length from above downwards: the first three are connected by their cartilages to the cartilages of the ribs above, whilst the two last, or Floating ribs, are absolutely free in front.

The Breast-bone or Sternum is a long flat bone running from the root of the neck to the pit of the stomach. Incomplete ossification at the lower end constitutes the deformity known as Chicken-breast.

Jointed to the top of the breast-bone on either side, and extending horizontally outwards to the shoulders, when they meet the shoulder-blades, are the Collar-bones. They are long bones curved like the italic letter *f*, the inner curve being convex to the front and the outer concave. These bones keep the shoulders wide apart, and in proportion to their length give a good carriage to their possessor.

The Shoulder-blades or Scapulæ lie upon the ribs at the upper and back part of the chest. They are of a flat

triangular shape, with the apex pointing downwards, and constitute the bony mass which moves on shrugging the shoulders.

At the outer angle of the scapula is the shoulder-joint, by means of which that bone articulates with the Humerus or single long bone of the upper arm.

The lower end of the humerus forms with the upper extremities of the two long bones of the forearm, the elbow-joint. The two bones of the forearm lie parallel to each other when the palm of the hand is turned upwards (supination), and are known as the Radius or outer bone, and Ulna or inner bone. When the palm is turned downwards (pronation) the lower end of the radius crosses behind the lower end of the ulna.

The Wrist or Carpus consists of eight small bones in two transverse rows of four each. To the lower row are jointed the five long bones of the hand (Metacarpal bones), and to the farther extremities of these are attached the three bones of the fingers and the two bones of the thumb.

On either side of the sacrum, and running outwards and forwards until they meet in front so as to form a ring or girdle, are two great plates of bone popularly known as the Haunch-bones. The whole osseous ring is called the Pelvis—a Latin word signifying basin.

The outer surface of each haunch-bone is in part hollowed into a deep cup-shaped cavity in which swings the rounded head of the great bone of the thigh. This bone, the Femur, is the largest bone in the body, and extends from the hip to the knee-joint.

From the knee to the ankle-joint the two long bones of the leg run side by side with each other. The outer

bone is the slender Fibula or splint-bone, and the inner the massive Tibia or shin-bone, so called because its surface can be felt below the skin on the front of the leg.

Covering the knee-joint is a flat plate of bone known as the knee-cap or Patella.

In man when the knee-joint is extended the tension of the ligaments or fibrous bands connected with it and the tension of the muscles absolutely prevent lateral and rotatory movements. The leg cannot be bent inwards like that of an ape. The fixation of man's knee-joint in the erect position is of fundamental importance in the act of standing.

The ankle-joint (tarsus) is formed by seven short bones arranged in two transverse rows. To the farther away row are attached the five long parallel bones of the Metatarsus or foot, and to each of them in turn the little bones of the toes. The great toe is set side by side with the other toes, and not at an angle to them as in the case of the thumb and the bones of the fingers. So that the foot in man is not an efficient organ of prehension, although savages may flex their toes on objects.

Yet it is very instructive and important to notice the general similarity in the arrangement of the bones of the upper and lower limbs. The collar-bones and shoulder-blades correspond to the haunch-bones, the single bone of the upper arm to the single bone of the thigh, the two parallel bones of the forearm to the two parallel bones of the leg, the eight bones of the wrist to the seven bones of the ankle, the bones of the hand to the bones of the foot, and the bones of the fingers to those of the toes. In short, the upper and lower extremities are moulded on

much the same lines. The arm was once a leg, and it only left off being a leg when we left off running about on all fours. By being liberated from locomotor functions it was freed to a greater range and variety of movement, and the hand by being adapted to serve as a perfect organ of prehension became effective in its ministrations to the intellectual purposes of man.

The union of two adjacent bones is effected by Joints. These may be either immovable or movable. In the first kind the bones may be knit together by the mediation of a plate of cartilage, or gristle as it is called in Scotland, or they may be dovetailed directly into one another by projecting pieces of bone, as in the flat bones of the skull-cap.

Movable joints, on the other hand, are divided into those with but a feeble range of movement and those in which the movement is more or less free. The former have the surfaces of the bones not only covered with cartilage, but are firmly connected by an intermediate disc of fibro-cartilage, the whole being bound together by ligaments. A typical example of this is to be seen in the joints of the Spinal Column. In the perfectly movable joints the surfaces of the bones are plated with smooth lubricated cartilage, and the joint is surrounded with enclosing ligaments. Of this description are the joints in the limbs. The form of these freely movable joints varies with the nature of the movements performed. Some have flat surfaces (*e.g.*, wrist-bones), others are rounded for rotation (*e.g.*, head of radius), others are pivot-shaped (*e.g.*, axis vertebra), and some are hinge-like with swivel (elbow), saddle-shaped (thumb), or oblong surfaces. If rotation at a joint takes place in every direction, a spheroidal head

fits into a cup, thus forming a ball-and-socket joint such as occurs at the hip and shoulder.

Movement of the bones at the joints is effected by the contraction of those Muscles which are under the influence of the Will. All voluntary muscles, indeed, are not concerned with the activity of bones. Some are engaged in the movement of such organs as the eye and tongue. But the major part is. Other muscles, constituting the great group of Involuntary Muscles, are of somewhat different structure and paler in colour. They form a main part of the walls of the contractile internal organs, and are engaged night and day in sustaining the complex movements of organic life. Obviously if those muscles were under our control we should soon make a mess of life. There is a classical story told of a gentleman who could stop the action of his heart for a few seconds. He did it once too often.

A Voluntary Muscle is made up of bundles which contain an enormous mass of fibres arranged in the long axis of the muscle. Each fibre consists of a group of cells which have not distinctly separated, and which contain a semi-fluid matter capable of contracting on appropriate stimulation. The whole muscle constitutes a fleshy mass or belly having a tendon or sinew at either end. These sinews are the ropes by which the muscle is attached to bones or other structures from which it arises or into which it is inserted.

Living muscle or flesh, in addition to being contractile, on stimulation, is possessed of the mechanical qualities of extensibility and elasticity. If stretched, it can recover its original length when the extending force is removed.

Actively contracted muscle is less elastic, and can be more easily stretched than muscle at rest. Fatigue and defective nourishment also reduce the elasticity. These mechanical properties of muscle are useful in preventing sudden contractions from tearing the tissue. And as muscles are normally stretched between their points of origin and insertion with slight tension, they are therefore able quickly to respond to a stimulus and to smoothly perform a movement.

Under ordinary circumstances in life a muscle is excited to contraction by the physiological stimulus which rises in the brain and is conveyed by the so-called motor nerves to muscles. The contraction is due to the splitting up of a complex nitrogenous body called Inogene into simpler, more stable chemical compounds. Some of these are forthwith excreted into the blood, the others help to build up again the original compound. This chemical operation in a contracting muscle is not a true oxidation, although it is capable of producing energy and heat. Yet the elaboration of inogene requires oxygen without doubt. For blood enters muscle rich in oxygen and poor in carbonic acid, and leaves it poorer in oxygen and rich in carbonic acid. Active muscle absorbs more oxygen than resting muscle; and although the amount of oxygen consumed bears no relation to the work done, yet the activity of muscle is preserved, and if need be restored, by a supply of oxygen. Oxygen as well as Nitrogen is, therefore, a food to muscle. And as the greater the amount of oxygen in the blood, the greater the ease with which muscle takes it up, so it is important that exercise should always be done with a plentiful supply of fresh air.

Inogene on being stimulated does not decompose with expansion. Unlike gunpowder, it explodes with contraction. The chemical change results in mechanical energy. But similar chemical changes are to a slight extent present also in passive muscle. And both degrees of decomposition, whether producing an obvious activity or accompanying an apparent passiveness, cause the evolution of a very considerable quantity of heat. The muscles, indeed, constituting as they do half the body weight, are a chief source of heat in the animal body. We not only move by muscle, but we also keep ourselves warm.

When a muscle contracts, the blood-vessels within it dilate, so that more blood is supplied and more lymph or nutritive material of the blood is exuded into the tissues. The arteries, or vessels carrying blood rich in food and oxygen to the tissues, are expanded by a nervous stimulus. Hence more blood spurts into the muscle. But this initial flow is soon obstructed by the mechanical compression of the contracting muscle, and it is not until the end of the contraction that the maximum increase of the current occurs. The removal of impure blood from the muscle by the veins and lymphatics is hastened by these vessels being squeezed during each contraction. As long as the quantity and quality of the blood supply is good, and as long as a sufficient time is given between continued muscular contractions to enable the inogene material to be elaborated, so long does the muscle, within limits, improve in nutrition, grow larger, and perfect its functional power. A muscle habituated to exercise can do more work, and do it better, than an unexercised muscle, because it is better supplied with contractile material in proportion to its

size: it is actually bigger, and it responds more quickly and completely to the stimuli which excite it to work. It is, however, important that an adequate period of rest should take place between physical efforts if a full development of muscle is to be obtained.

Fatigue or exhaustion of muscle after prolonged or severe exercise is physiologically due either to the accumulation of the chemical products of contraction, or to the defect of oxygen and other supplies, or to both of these causes combined. Hence the renewal of the blood current is quickly followed by the revival of the fatigued muscle. One does not so easily become exhausted if a meal has been taken at a suitable interval before engaging in muscular effort, and if the exercise is carried out in the open air. The feeling of great weariness, when it does occur, may be relieved by massage to remove the waste materials, by stimulation of the circulation, by fresh air, by sleep, and at a proper time by the supply of nutritious and, if need be, artificially digested nitrogenous food; or it may be lessened by a warm bath, which, by withdrawing blood from the muscles, moderates the activity of the changes going on within them. This was a habit of the great Napoleon.

Cold baths of short duration after moderate exercise produce a physiological dilatation of the minute vessels of the muscles and skin, and thereby overcome ordinary fatigue. The degree of cold and the duration of the bath to give this effect vary with each individual. No bath should be so cold or so prolonged as to prevent natural reaction and the consequent feeling of warmth. Resistance to muscular fatigue is also increased by douches and

sprays of various temperatures, each pound of pressure having a positive effect. A douche of 50° F. delivered under a pressure of 30 lbs. to the square inch exalts muscular capacity threefold. Sandow recommends cold splashing of the body with water, followed by immersion from one to fifteen seconds, according to the season of the year, but opposes stimulation of the skin by friction with a towel, which he believes tends to an unequal instead of a general reaction. The bath should be taken immediately after morning exercise as soon as one has ceased to be out of breath.

It is experimentally found that the power to do voluntary muscular work is diminished by general and local fatigue, hunger, decreasing atmospheric pressure, high temperature, humidity, and tobacco; and it is increased by exercise, rest, sleep, food, increasing atmospheric pressure, and alcohol.

Psychologically, fatigue for a particular voluntary movement is due to a fatigue of its special will power. It does not mean necessarily a fatigue for other voluntary acts—a change of movement is often a relief—although it is also quite possible that the total will power of an individual may be generally fatigued. This nervous exhaustion is expressed by the two sides of the body acting unequally and in an irregular manner, so that asymmetry of posture and of effort result. A tired pupil can easily be detected by the head being bent to one side, the muscles of the face relaxed, and the more feeble hand being partially bent at the wrist, and other joints and the palm much contracted. Excessive fatigue causes dreaminess and loss of the faculty of attention.

The actual energy of muscular contraction varies with the cross-section of the muscle and not with its length; in other words, the thicker a muscle the stronger it is. A muscle does the greatest amount of work against a moderate load, and is not so powerful when stretched as when partially contracted. This should be borne in mind by the athlete who desires to obtain the greatest possible amount of strength in a given movement.

From a mechanical point of view the arrangement of the muscles, sinews, and bones of the human body presents examples of levers of the first, second, and third order—that is to say, of levers in which the fulcrum is between the power and weight, or levers in which the weight is placed between the fulcrum and power, or levers in which the power is applied between the fulcrum and weight. The last is the commonest. The triceps or muscle on the back of the upper arm extending the lower arm is an example of the first order, the muscles of the calf raising the body on tiptoe of the second order, and the action of the biceps in flexing the forearm of the third order. Generally speaking, therefore, the mechanical arrangement of the muscles is to attain quickness and range of movement at the expense of strength.

In all regulated muscular effort of any given group of muscles there is usually associated with it contraction of the antagonistic muscles. Thus flexion or bending of the fingers on the palm is accompanied by contraction of the extensor muscles also. This natural co-operative antagonism of muscles renders the effective action of a muscular group still more effective, especially as the

antagonism is not sufficient to prevent the opposing muscles from being elongated, and thus by their elasticity securing the steadying effect that is essential to all delicate adjustments. It prevents jerking or spasmodic action, and ensures co-ordination. The regulating tension can be increased at will, and held in apparent inaction with great advantage to the rapidity and certainty of the effort—a fact well known to skilful fencers.

When a group of muscles contract, but are prevented from being shortened or are actually elongated during a contractive effort, more blood passes through them in a unit of time than passes through muscles which are contracted and shortened, for the arteries are less compressed. Resistance to contraction is, therefore, very beneficial in furthering the nutrition of a group of muscles.

Hence it is always a good plan to perform any physical drill by a voluntary effort of resistance to the actual exercise engaged in, so as thus to increase the development and co-ordination of the parts. In some exercises —such as rope-climbing, pulling the chin above a horizontal bar, and physical drills in which the lower limbs are bent and extended when the body is in an erect position—the resisting force being the weight of the body is incidental to the nature of the movement. In others, resistance to movement may be effected artificially by the application of such force to the extremity of a limb as to cause it to tend to move in an opposite direction to the action of its voluntary contracting muscles. Dumb-bells are the most primitive method of obtaining this result. These resisted exercises are characteristic of

the Swedish and American systems of physieal drill. In many of the movements of Swedish Drill, resistance is effected by an assistant, who exactly adapts the amount of foree he employs to the capacity of the pupil. The so-ealled Home Exercises and Health Exereises and Zander's Apparatus exhibit a great deal of ingenuity in devising a meehanieal apparatus of pulleys, handles, and weights to enable one to engage by himself in many movements in whieh the element of resistance is carefully regulated. A like effeet may also be produeed by means of elastie eords, the distanee to whieh they are extended from their point of attachment determining the degree of resistance. For museular development, movements overcoming resistance are good; but moderate efforts overcome by resistance are better, because the contraeting museles, being stretched, reeeive a greater supply of blood. This ean be done with elastie exercisers by partially opposing the elastieity of the eords when expanded, or with other forms by opposing with inferior foree the gravitation of the weights.

The seeret of how to get strong is to practise resisted movements with each group of museles in the body for a short time every day, graduating within moderate limits the amount of resistanee with the inerease in strength. On eaeh occasion begin and end with easy exercises. Symmetrical development of the museles must be invariably aimed at. Measurements should be taken at regular intervals. Be eontent with gentle progress, and avoid exeess.

Short of aetual eontraction of a muscle, the normal movement of its eell eontents may be stimulated by

the mechanical communication of motion from an external source. This is the physiological basis of Massage, the procedure of which may be divided into four principal manipulations. One consists in stroking the parts towards the body or the heart, so as to excite the circulation and thereby cause absorption; another in firm circular frictions followed by centripetal stroking, so as to transform pathologically changed parts into a condition which will enable them to be incorporated into the healthy tissue and then be absorbed by the veins and lymphatics; another in kneading the tissues; and a final one in lightly beating or tapping the parts to be affected. By these means there is a stimulation of the interchange of cell contents under the influence of alternate pressure and relaxation, a quickened movement of the blood, especially in the muscular tissue, acceleration of the blood and lymph in their respective channels, stimulation of the absorbents, and increased functional activity and growth.

In order to study the action of voluntary muscles in connection with the movements at joints, a physiological plan is to be preferred to a topographical one. According to Nunn, these muscles are arranged in two great divisions which are opposed to each other. On the front of the trunk and limbs are placed the flexor or bending and doubling-up muscles, and behind the body and limbs are placed the extensor or straightening-out muscles. There are, it is true, a few muscles on the outer side of the limbs whose functions are to raise the limbs laterally outwards, but they are practically extensor muscles; and there are also a few muscles on the inside

of the limbs, which draw the limbs close to the trunk or to each other, which are practically flexors. So that we may make the general statement, that when the body is standing erect with the palms of the hands forward, the muscles on the front of the trunk and front and inner side of the limbs down to the knees are flexors, while those on the back of the trunk and back and outer side of the limbs are extensors. Below the knees this order is reversed.

From birth the flexor muscles are stronger than the extensors and prevail over them. A newly born child has experimentally been shown to be able to support its own weight by the grasp of the flexor muscles of the hands and arms for a period worthy of a professed gymnast, and which is highly suggestive of being the survival of an arboreal existence. But the same infant hardly possesses the power to straighten its fingers or limbs by the use of the extensors. This relative greater muscularity of the flexors continues through life, and is the cause of the curling up of the body and limbs when asleep, the slouching round-shouldered gait of the untrained rustic, and the bent attitude of old people. Moreover, most of the occupations of civilised life—such as reading, writing, and sewing—favour the assumption of flexed positions of the body, narrow the chest, obstruct the circulation, and compress the organs of digestion.

Hence it is of prime importance that physical instruction should be particularly devoted to those exercises which strengthen the extensor or opening-out muscles, and thereby counteract the natural and acquired tend-

encies to overaction of the flexors—that it ought, in fact, to be primarily concerned with developing the capacity to maintain that erect position which is distinctive of the human species.

[1] The spine, limiting the name to the two dozen true vertebræ which are perched upon the sacrum, is a flexible bony column supported and moved by a complicated series of muscles (*vide* fig. 2, p. 28). The entire spine is bent back, as when carrying weights in front of the body, by two large masses of muscle situate on either side of it posteriorly (trapezius, rhomboideus major, latissimus dorsi, serratus postieus superior and inferior, sacrolumbalis, longissimus dorsi, spinales dorsi, semi-spinales dorsi, multifidus spinæ, intertransversalis dorsi et lumborum). These muscles also act in raising the spine from the bent to the erect position. It is bent to one side when one of these masses contracts alone (latissimus dorsi, sacrolumbalis, longissimus dorsi, serratus postieus, obliquus externus and internus, and quadratus lumborum). It is bent forward by muscles situate on the anterior aspect of the backbone at its upper and lower parts, and by muscles on the front of the belly inserted into the ribs (psoas magnus and parvus, pyramidalis, rectus abdominis, obliquus externus and internus, and quadratus lumborum, assisted when the arms are carried forwards by the pectoralis major and minor and serratus magnus). These flex the trunk upwards in climbing. Screwing or rotatory movements of the spine are effected by a series of muscles arranged in layers between the vertebral bones (semispinales, multifidi and rotatores spinæ) assisted by the abdominal muscles.

The head is poised on the top of the spine, and is maintained in a quiescent position without any appreciable muscular effort, but it can be moved in various directions. It is bent forwards by the platysma myoides, sternomastoid, rectus anticus major

[1] This part may be omitted by the general reader.

and minor, and longus colli, assisted, when the lower jaw is fixed by the mylohyoid, geniohyoid, geniohyoglossus, and digastrici (*vide* figs. 3, 4, 5, 6, pp. 30, 32). It is drawn backwards by the splenius capitis, complexus, trachelomastoid, major and minor posterior recti, obliquus capitis superior, and part of the trapezius. It is bent to either side by the platysma myoides, sternomastoid, part of the trapezius, splenius capitis, splenius colli, trachelomastoid, and complexus.

The neck is moved forwards by the platysma myoides, sternomastoid, digastric, mylohyoid, geniohyoglossus, geniohyoid, omohyoid, sternohyoid, thyrohyoid, rectus anticus minor, and longus colli; backwards by part of the trapezius, by the major rhomboid, serratus posticus superior, splenius capitis and colli, complexus, trachelomastoid, transversalis colli, interspinales colli, semispinales colli, rectus posticus major and minor, superior and inferior obliquus capitis, scaleni postici, and levator scapulæ; and laterally by various combinations of those muscles which separately move it forwards and backwards, assisted by the scaleni, intertransversales, and recti laterales.

The capacity of the chest is increased in ordinary respiration by the diaphragm, levatores costarum longi et breves, and intercostal muscles. In forced or extraordinary respiration the muscles of the trunk which pass to the upper limbs by taking their fixed point at the limbs, act as elevators of the ribs (three scaleni, sternocleidomastoid, trapezius, pectoralis minor, serratus posticus superior, rhomboidei, extensors columnæ vertibratis, serratus anticus major), and are assisted by certain muscles of the larynx, pharynx, and face.

During ordinary respiration the chest cavity is diminished by the weight of the chest walls, by the elasticity of the lungs and costal cartilages, and by the contraction of the muscles on the front of the abdomen or belly. During forced expiration the external and internal oblique and transverse muscles of the abdomen, part of the internal intercostals, the triangularis

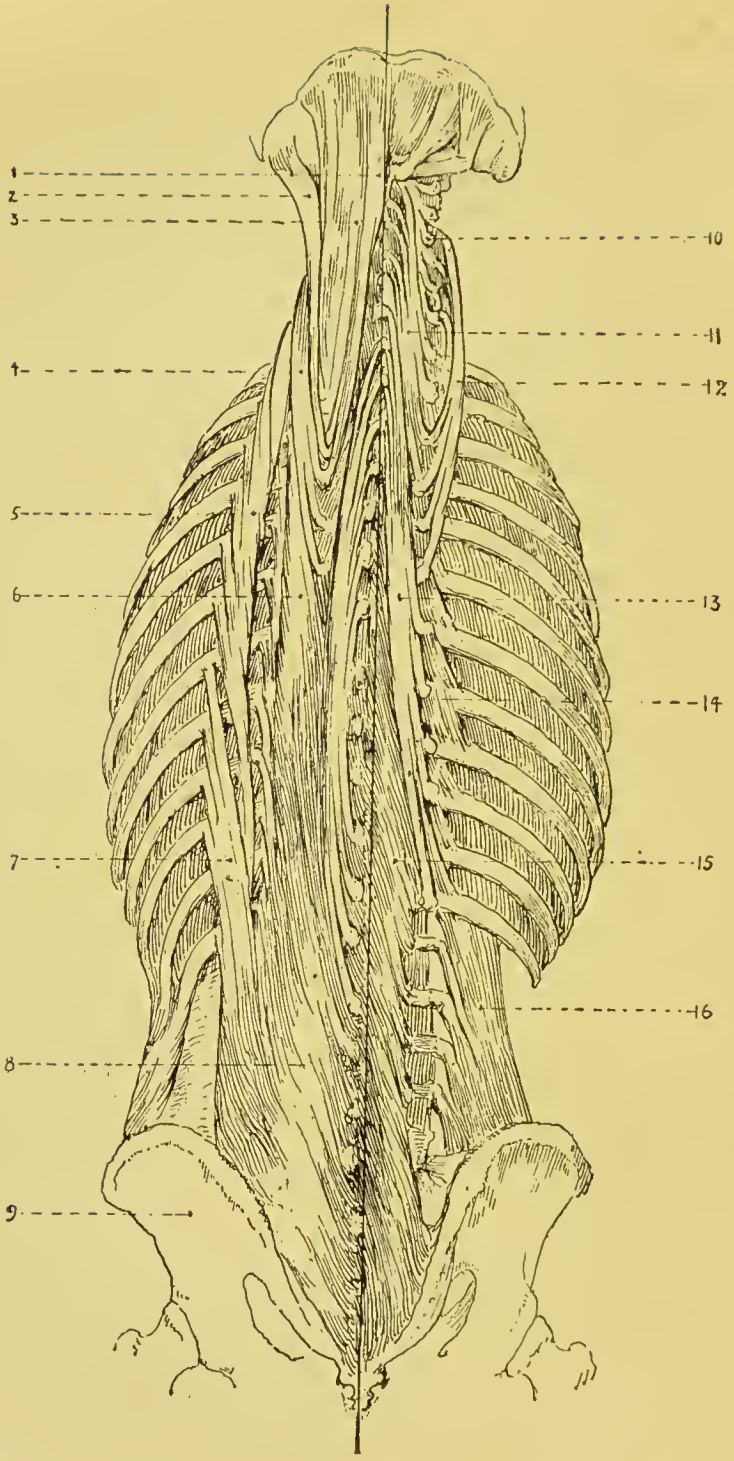

Fig. 2.

FIG. 2.

1. Biventer cervicalis.
2. Trachelomastoid.
3. Complexus.
4. Transversalis colli.
5. Accessorius, continued upwards as Cervicalis ascendens.
6. Longissimus dorsi.
7. Sacro-lumbalis.
8. Erector spinæ.
9. Haunch-bone.
10. Multifidus spinæ.
11. Semi-spinalis colli.
12. Transversalis colli.
13. Semi-spinalis dorsi.
14. Levatores costarum.
15. Multifidus spinæ.
16. Quadratus lumborum.

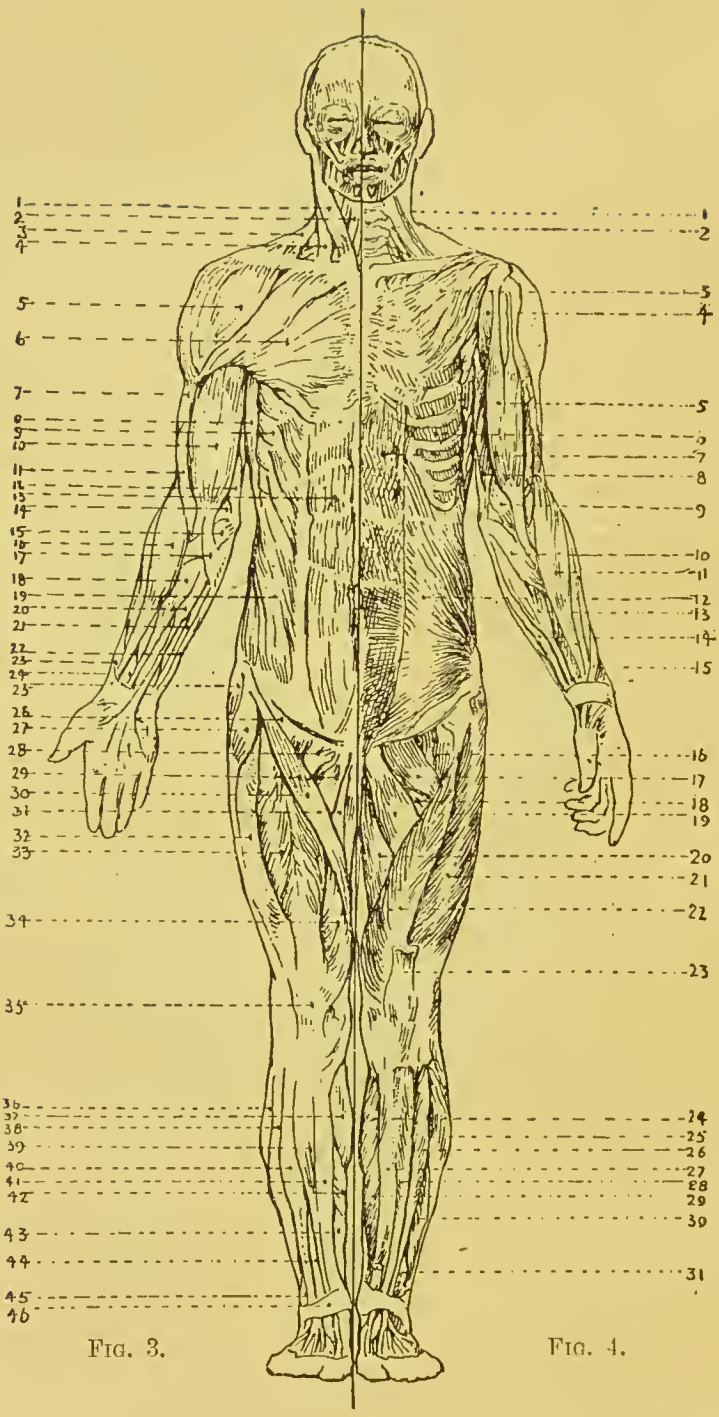
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Fig. 3. Fig. 4.

FIG. 3.

1. Sterno-mastoid.
2. Sterno-hyoid (outer) and omo-hyoid (inner).
3. Trapezius.
4. Clavicular portion of sterno-mastoid.
5. Deltoid.
6. Pectoralis major.
7. Triceps.
8. Latissimus dorsi.
9. Serratus magnus.
10. Biceps.
11. Brachialis anticus.
12. Triceps.
13. Rectus.
14. Brachialis anticus.
15. Pronator radii teres.
16. Supinator longus.
17. Aponeurotic slip of biceps.
18. Flexor carpi radialis.
19. External oblique.
20. Palmaris longus.
21. Flexor sublimis digitorum.
22. Flexor carpi ulnaris.
23. Extensor ossis metacarpi pollicis.
24. Extensor primi internodii.
25. Gluteus medius.
26. Psoas and Iliacus.
27. Tensor vaginæ femoris.
28. Pectineus.
29. Adductor longus.
30. Sartorius.
31. Gracilis.
32. Vastus externus.
33. Rectus femoris.
34. Vastus internus.
35. Patella (bone).
36. Peroneus longus.
37. Inner head of Gastrocnemius.
38. Peroneus brevis.
39. Tibialis anticus.
40. Extensor longus digitorum.
41. Tibia (bone).
42. Inner part of Solcus.
43. Flexor longus digitorum.
44. Extensor proprius pollicis.
45. Peroneus tertius.
46. Annular ligament.

FIG. 4.

1. Scalenus posticus.
2. Scalenus anticus.
3. Pectoralis minor.
4. Coraco-brachialis.
5. Biceps.
6. Intercostals.
7. Rectus.
8. Triceps.
9. Brachialis anticus.
10. Pronator radii teres.
11. Supinator brevis.
12. Internal oblique.
13. Flexor profundus digitorum.
14. Flexor carpi ulnaris.
15. Extensor primi internodii.
16. Psoas and Iliacus.
17. Pectineus.
18. Adductor magnus.
19. Adductor brevis.
20. Adductor longus.
21. Vastus externus.
22. Vastus internus.
23. Tendon of rectus.
24. Gastrocnemius.
25. Peroneus longus.
26. Extensor communis digitorum.
27. Tibia (bone).
28. Tibialis anticus.
29. Soleus.
30. Peroneus brevis.
31. Peroneus tertius.

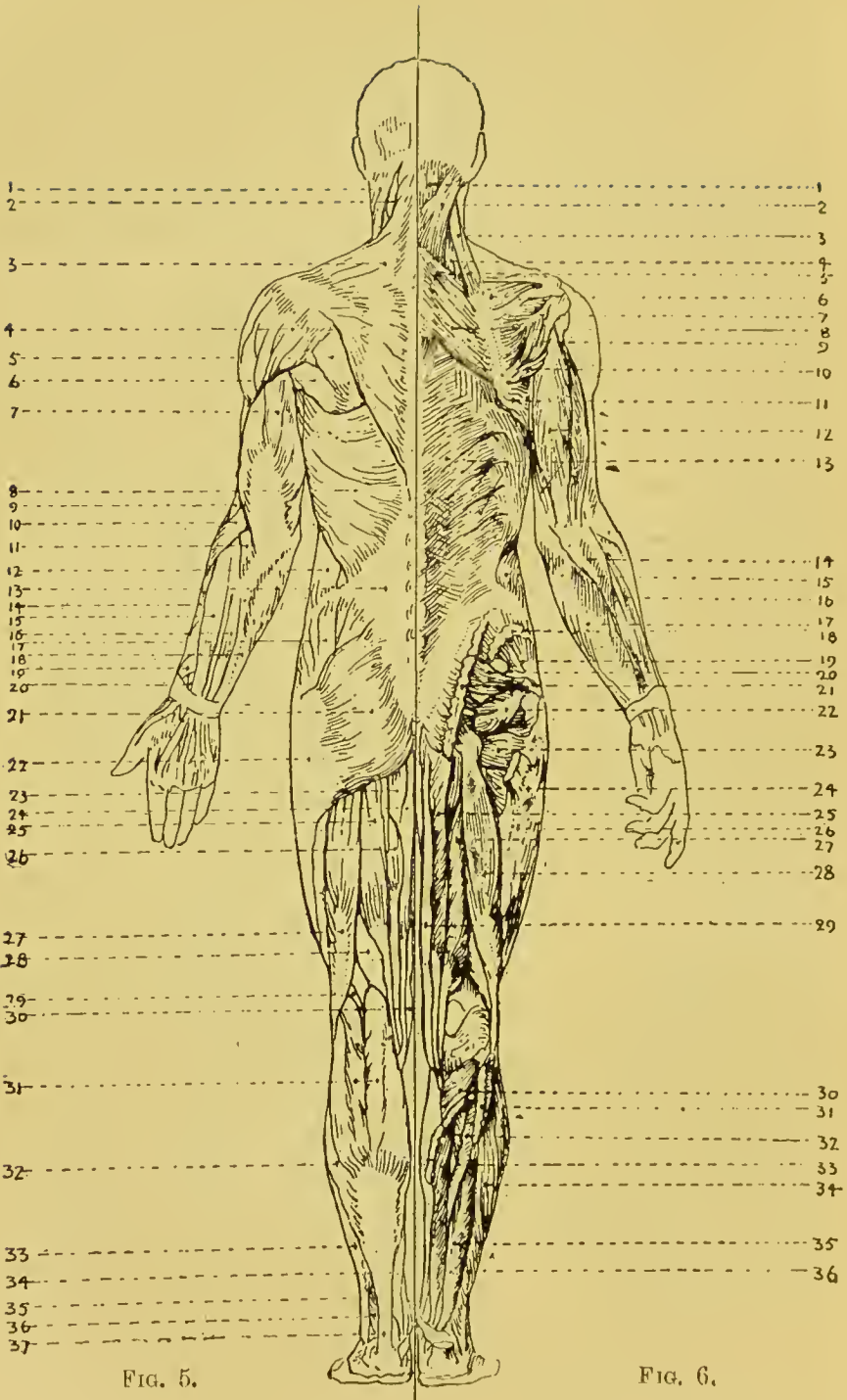
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FIG. 5.

FIG. 6.

FIG. 5.

1. Sterno-mastoid.
2. Splenius capitis.
3. Trapezius.
4. Deltoid.
5. Infra-spinatus.
6. Teres major.
7. Triceps.
8. Latissimus dorsi.
9. Brachialis anticus.
10. Extensor carpi radialis longior.
11. Anconeus.
12. External oblique.
13. Lumbar fascia.
14. Extensor carpi radialis brevior.
15. Extensor digitorum communis.
16. Extensor minimi digiti.
17. Glutens medius.
18. Extensor carpi ulnaris.
19. Extensor ossis metacarpi pollicis.
20. Extensor primi internodii pollicis.
21. Gluteus maximus.
22. Fascia lata.
23. Adductor magnus.
24. Gracilis.
25. Semi-tendinosus.
26. Semi-membranosus.
27. Biceps.
28. Short head of biceps.
29. Plantaris.
30. Sartorius.
31. Gastrocnemius.
32. Soleus.
33. Peroneus longus.
34. Flexor longus digitorum.
35. Peroneus brevis.
36. Flexor longus pollicis.
37. Tendo Achillis.

FIG. 6.

1. Complexus.
2. Splenius capitis.
3. Levator anguli scapulæ.
4. Scalenus medius.
5. Rhomboideus minor.
6. Supra spinatus.
7. Infra spinatus.
8. Rhomboideus major.
9. Teres minor.
10. Teres major.
11. Serratus magnus.
12. Triceps.
13. Serratus posticus inferior.
14. Supinator brevis.
15. Internal oblique.
16. Extensor carpi ulnaris.
17. Extensor ossis metacarpi pollicis.
18. Cut end of gluteus medius.
19. Gluteus minimus.
20. Pyriformis.
21. Cut end of gluteus maximus.
22. Gemelli and obturator internus.
23. Quadratus femoris.
24. Adductor magnus.
25. Semi-membranosus.
26. Vastus externus.
27. Semi-tendinosus.
28. Biceps.
29. Gracilis.
30. Popliteus.
31. Cut end of soleus.
32. Tibialus posticus.
33. Flexor longus digitorum.
34. Peroneus longus.
35. Flexor longus pollicis.
36. Peroneus brevis.

sterni, serratus postieus inferior, and quadratus lumborum are brought into play.

The movements of the upper limb on the trunk take place at the joint between the collar and breast bones, and eonsist in the elevation, depression, and forward and backward movements of the shoulder.

Movements at the joint between the collar-bone and shoulder-blade oeeur when the shoulder-blade is rotated on the collar-bone in the act of raising the arm above the head. The muscles whieh cause these movements are inserted into the bones of the shoulder-girdle (trapezius, rhomboid, levator anguli scapulæ, serratus magnus, peetoralis minor, and subclavius). Elevation of the entire shoulder, as in supporting weights, is due to the contraetion of the trapezius, levator scapulæ, and rhomboid; depression partly to the weight of the limb and partly to the action of the subclavius and pectoralis minor. Movement forward is caused by the serratus and pectoralis, and baekwards by the trapezius and rhomboid. In rotation of the shoulder-blade on the eollar-bone, the seapula is drawn forwards by the serratus and lower fibres of the trapezius, and backwards by the levator scapulæ, rhomboid, and lesser pectoral.

At the shoulder-joint a general range of movement is possible. For descriptive purposes and for drill it is divided into abduction and elevation or extension of the arm outwards and upwards, adduction or depression, movement forward and elevation, backward movement, rotation outwards, rotation inwards, and a combination of these to eause swinging of the arm or eircumduction. Abduction is due to the supraspinatus and deltoid assisted by the infraspinatus and teres minor: adduction to the coracobrachialis, latissimus dorsi, pectoralis major, subseapularis, and teres major assisted by the weight of the limb: movement forwards and elevation to the anterior fibres of the deltoid, pectoralis, and subscapularis: baekwards to the latissimus and teres major: rotation outwards to the infraspinatus and teres minor: and rotation inwards to the

subscapularis, pectoralis major, latissimus, and teres major. The supraspinatus and deltoid elevate the arm to a certain extent, but farther elevation, as in raising the arm above the head, is effected by the trapezius and serratus, which rotate the shoulder-blade and draw its inferior angle forwards. When both arms are fixed, as in climbing or in walking on crutches, the trunk is drawn forward by the latissimus dorsi, pectoralis major, and teres major.

The forearm is flexed at the elbow-joint by the biceps, brachialis anticus and pronator teres, assisted by the flexor carpi radialis, flexor sublimis, flexor ulnaris, and supinator longus muscles of the forearm. It is extended by the triceps and anconeus, the fleshy mass on the back of the upper arm.

At the radio-ulnar joint it is rotated outwards into the supine position in which the palm is turned upwards by the biceps, supinator brevis and extensor secundi internodii, and it is rotated inwards to the prone position with the palm downwards by the pronator teres, flexor carpi radialis, palmaris longus, flexor sublimis, and pronator quadratus.

The wrist is bent forwards by the flexor carpi radialis, palmaris longus, flexor sublimis, flexor carpi ulnaris, flexor profundus, and flexor longus pollicis, muscles situate on the front of the forearm. It is bent backwards by the extensor carpi radialis longior and brevior, extensor secundi internodii, indicator, extensor communis digitorum, and extensor proprius pollicis, muscles situate on the back of the forearm. It is moved outwards by the flexor carpi radialis, extensor carpi radialis longior and brevior, extensor ossis metacarpi, and extensor primi internodii. It is moved inwards, the palm being uppermost, by the flexor sublimis, flexor carpi ulnaris, flexor profundus, extensor communis digitorum, extensor minimi digiti, and extensor carpi ulnaris.

The thumb is moved inwards and forwards across the palm by the opponens pollicis, flexor brevis, and flexor longus; outwards and backwards by the extensor ossis metacarpi pollicis,

extensor primi internodii, and extensor secundi internodii; upwards and forwards away from the other fingers by the abductor pollicis assisted by the flexor brevis; and backwards and inwards to the other fingers by the abductor pollicis, extensor primi internodii, and extensor secundi internodii.

The muscles acting on the thigh at the hip-joint form the fleshy masses on the buttock and front and inner side of the thigh. The thigh is bent forwards by the psoas magnus, iliacus, tensor vaginæ femoris, pectineus, and adductor longus and brevis. It is extended backwards by the gluteus maximus, part of the gluteus medius, the pyriformis, obturator internus, part of the adductor magnus, the long head of the biceps, the semi-tendinosus and semi-membranosus. It is drawn inwards by the psoas magnus, iliacus, pectineus, gracilis, adductors longus, brevis, and magnus, the obturator externus and quadratus femoris. It is raised outwards by the tensor vaginæ femoris, gluteus maximus, medius, and minimus, and pyriformis. It is rotated inwards by the tensor vaginæ femoris and part of the gluteus medius, and when the leg is extended, by the sartorius and semi-tendinosus. It is rotated outwards or everted by the gluteus maximus and part of the medius, the pyriformis, gemellus superior and inferior, obturator internus and externus, quadratus femoris, psoas magnus, iliaeus, adductor longus, brevis, and magnus, and slightly by the biceps.

At the knee-joint the leg is flexed backwards by the semi-tendinosus, bieeps, semi-membranosus, gracilis, sartorius, and popliteus. It is extended by the reetus, erureus, and vastus externus and internus.

The foot is bent forwards and upwards at the ankle-joint by the tibialis anticus, extensor proprius pollieis, extensor longus digitorum, and peroneus tertius museles on the front of the leg. It is extended by the gastroenemius, plantaris, soleus, flexor longus digitorum, flexor longus pollicis, tibialis postieus, and peroneus longus and brevis muscles on the back and outer side of the leg.

The foot is inclined inwards at the joints between the small tarsal bones by the extensor proprius pollicis, flexor longus digitorum, flexor longus pollicis, and tibialis postieus, and outwards by the peroneus longus and brevis, extensor longus digitorum, and peroneus tertius.

The toes are flexed on the sole by the abduetor pollieis, flexor brevis digitorum, abduetor minimi digiti, flexor longus pollieis, flexor digitorum, flexor aeeessorius, lumbraeales, flexor brevis pollieis, adduetor pollieis, flexor brevis minimi digiti, and interossei. They are extended by the extensor longus digitorum, extensor proprius pollieis, and extensor brevis digitorum. They are inelined inwards by the abduetor pollieis and interossei, and outwards by the abduetor pollieis, abduetor digiti minimi, and interossei.

The ereet position on both feet is maintained with but a small expenditure of museular power, owing to the meehanical arrangements of the joints and ligaments. Strong fibrous bands prevent the body falling forward, and other bands prevent it falling sideways. When, however, the trunk is bent forwards, the museles of the hip are brought into aetion to prevent equilibrium being destroyed. And if the balanee of the body is to be preserved when standing on one foot, various museles of the trunk and lower limb must be brought into vigorous exertion.

To keep the whole machinery of the muscular system in working order, fresh supplies must be brought to the tissues in the form of food and oxygen, these substances must be transformed so as to effect organic growth and repair and the production of energy, and the waste matters must be excreted from the tissues. The conversion of articles of diet into a soluble state is known as Digestion, its conveyance to the blood and lymph as Absorption, the saturation of the blood with oxygen as Respiration, the conveyance of nutriment and oxygen to

every part of the body as Circulation, the chemical changes in the tissues as Metabolism, and the removal of waste and useless products from the body as Excretion.

That nutrition may be effective the proper quality and quantity of food must be supplied. It is therefore necessary to ascertain the kinds of food required in order that the income of the body may balance the expenditure.

Foods are classified by chemists into Proteids or Nitrogenous bodies—such as flesh, white of egg, cheese, peas, beans, and lentils; Carbohydrates, consisting of sugars and starches—such as bread and other farinaceous foods; Fats, Salts, and Water. It is essential that a normal diet should contain all those proximate principles. The absence of any of them kills if persisted in. No one article of diet, except milk, is nearly a perfect food. Yet most edible materials contain several or all of these constituents in varying proportions. It is, however, convenient, when the quantity of any one proximate principle is high, to refer to the substance as belonging to that particular kind of food. Thus meat, chicken, white fish, and cheese are spoken of as nitrogenous foods although they contain some fat, salt, and water. Flour, oatmeal, and rice are considered starchy foods although they have a certain percentage of albuminous or proteid matter.

For an adequate diet the proximate principles of any mixture of food should adhere to a well-recognised relative proportion. Experience proves that the diet best suited for the body must contain 1 part of nitrogenous food to $3\frac{1}{2}$ or at most $4\frac{1}{2}$ of non-nitrogenous. To live on beef alone, we should have to eat each day a quantity corresponding to $\frac{1}{25}$ of our body weight—an

amount practically indigestible, and in other ways excessive. To live on potatoes alone would be still more harmful. In everyday life we mix our food. The Englishman has roast beef and potatoes, the Scotsman porridge and milk, and the Irishman milk and potatoes.

According to Parkes, a healthy adult requires in twenty-four hours $3\frac{1}{2}$ to $4\frac{1}{2}$ pints of water, including the 50 to 60 per cent of water in food, while the average amount of solid food free from water ought to be in the proportions given in the following table:—

OUNCES OF WATER-FREE SOLIDS REQUIRED BY AN AVERAGE MAN.

	At rest.	Ordinary work.	Laborious work.
Proteids	2·5	4·6	6 to 7
Fats	1·0	3·0	3·5 to 4·5
Carbohydrates . . .	12·0	14·4	16 to 18
Salts	0·5	1·0	1·2 to 1·5
Total water-free solids . .	16·0	23·0	26·7 to 31·0

Practically as well as theoretically, it is found that a scheme of diet should be based on the following allowance —viz.: 1 lb. of bread, $\frac{1}{2}$ lb. of meat, $\frac{1}{4}$ lb. of fat, with as accessories to supplement the fundamental diet, 1 lb. of potatoes, $\frac{1}{2}$ pint of milk, $\frac{1}{4}$ lb. of eggs, $\frac{1}{8}$ lb. of cheese. Health can be indefinitely sustained on this diet, although a still greater variety of equivalent foods may be beneficially substituted from time to time.

Tables of the nutritive value of foods resting on their percentage composition are misleading. The available nutritive value differs although the composition is similar. Some substances are more digestible than others. Peas are not so easily absorbed as meat. The mode of cooking has also a perceptible effect. Soft-boiled eggs are fairly

light, but hard-boiled eggs are extremely resistant to digestion. A nourishing food ought also to be palatable, so as to stimulate the alimentary secretions. When an alderman's mouth waters he digests his dinner better.

The growth and repair of the human body is entirely due to the proteid matter of food. But of all the proteids rendered soluble by digestion and absorbed into the blood, only a small proportion is actually organised into living tissue. The greater part of the circulating proteid is acted on and used by the organs for their functional activities. Some of it is converted into a starchy material, some into sugar, and some into fat. But the main duty of the proteids is to perform the work of the body. Hence they are necessary at all periods of life. An active, growing child, after infancy, requires relatively more albuminous food than an adult. And the more laborious is the muscular or other work performed by a man, the greater is the amount of nitrogenous food which he ought to consume. Pampas Indians, who spend their lives on horseback, subsist largely on animal food. In short, muscle must be used in using muscle, or at all events a highly nitrogenous vegetable food of easy digestion.

Fat is simply stored up in the body as fat. Carbohydrates, on the other hand, are transformed into the same starchy material as proteids are—into sugar, and perhaps into fat. Some of the carbohydrates are a variety of sugar when eaten, and starches by the process of digestion become sugar also. Neither fats nor carbohydrates are able to support life. But their addition to the diet economises the destruction of proteids, so that starchy food, sugar, and fat are fattening. Conversely, proteids

in the diet hasten the consumption of fat in the body. This is practically taken advantage of in the system known as Banting.

In dieting for severe muscular effort those principles should be borne in mind. Any regimen which leads to disorder of the stomach and increases thirst is injurious. It will be seen that the athlete requires a liberal amount of nitrogenous food of a digestible character. He should eat such animal foods as roast beef, steak, lamb, mutton, white meat, boiled fish, sweetbread, tripe, lightly cooked or whipped eggs, and custards, but avoid pork, bacon, salted meat, smoked and kippered fish, and hard-boiled eggs. He may partake sparingly of cheese. Of vegetable foods, those which are comparatively rich in nitrogen and at the same time easily digestible he may enjoy—such as porridge, biscuits, stale bread, and an occasional sponge-cake. Those which are more purely starchy—such as rice, sago, and tapioca—should be partaken of sparingly. Potatoes, beetroot, cabbages, and other green vegetables ought to be avoided. Sugar should only be indulged in very slightly. Saccharine may be substituted for it by those who do not fear a mawkish taste. Jam should be altogether excluded. Fruit should, as a rule, be prohibited. Even the so-called sour fruits consist chiefly of sugar. The free acids and principles in fruit readily undergoing change are apt to excite derangement of the alimentary canal. Fat in the form of butter, cream, pastry, and dumplings is not to be thought of. Of all single foods cow's milk is one of the most excellent, but it cannot be taken in large quantities at a time. It is rendered

more easy of digestion if diluted with barley-water. During prolonged muscular exercise, when rest is impossible and nourishment must be taken, the food ought to be of such a nature as to require but little digestion. Iron-workers often sustain themselves with a drink of oatmeal-and-milk. Some athletes use chocolate-and-milk. The value of artificially digested foods under these circumstances is apparent.

Of beverages water is the best. If slightly acidulated with a very little lime-juice, it quenches thirst more readily. Too much liquid of any form taken without solid food is apt to cause flatulent distension of the stomach and interfere with the action of the heart. For a like reason aerated waters are generally recognised as undesirable in training. An excessive quantity of liquid taken with food dilutes the digestive juices to an injurious degree. Coffee, tea, and chocolate act as stimulants to the nervous system. Cold tea is very refreshing, but, whether hot or cold, it interferes with digestion. So to a lesser extent does coffee. Coca was long used by the natives of Peru to stimulate the nervous system, and to support the strength for a considerable time, in the absence of food, by putting off the sense of fatigue and hunger. It might be taken very exceptionally as wine, but is apt to degenerate into an injurious habit. Alcohol acts as a substitute for the consumption of the tissues in the body, especially when the amount of food is insufficient. It is more rapidly given off by the blood, and therefore less harmful on the hills than in the plains, but, as it lowers the temperature, it is excluded at the snow-line. As a stimulant to the circulation it should

be drunk strong, but for all other purposes well diluted. The golden rule is, that alcohol should only be taken by those below par. It should never be used regularly by those in vigorous health. Ale and beer are inadmissible before or during exercise, if indeed they should be allowed at any time. Of wines, claret and still hock are least harmful, port is too heavy, and sherry disorders the stomach. Meat-soup and beef-tea, so much extolled as strength-givers, are only stimulants supplying the muscle with restoratives. They may be used as beverages, but are not food in the proper sense of the term.

Tobacco in moderation produces no bad effect on an athlete beyond a tendency to repose and an increased liability to fatigue. If used at all, it should therefore not be resorted to before any severe physical work. Moreover, it spoils the wind. Excessive smoking is distinctly injurious. It affects the heart and eyes, and is apt to cause muscular trembling. For those reasons experienced riflemen seldom smoke before shooting. The action on the heart varies with the kind of tobacco indulged in. Pigtail, bogie-roll, or Irish twist, causes an irregularity which will continue so long as the smallest quantity of that tobacco is employed. Finer brands, on the other hand, if used habitually in excess, are more apt to produce sudden attacks of faintness. This danger is less if one variety of tobacco is adhered to than if changes are made.

Blood is the means by which food and oxygen are supplied to the tissues and waste matter removed from them, and is thus the great go-between for nourishing the body. It is pumped from the heart through a system of closed tubes consisting of branching vessels or arteries

which convey the fluid from the central organ to the tissues, then of minute ramifying vessels, the capillaries, which distribute the blood through the tissues, and finally of coalescing large pipes, or veins, which carry the blood from the tissues back again to the heart. This is known as the Systemic Circulation. A lesser arrangement by which impure blood is circulated between the heart and lungs also exists. From the capillaries the nutritive fluid of the blood is exuded as Lymph, part of which finds its way into the veins, and part is returned to the circulation by a system of vessels known as the lymphatics.

The increased activity of a muscle is accompanied by a nervous dilatation of its arteries, so that more blood is sent to the organ. When the area of muscular contraction is large, the blood current, being obstructed during the actual contraction, is thereby increased in pressure for a time; but after the contraction is over, the subsequent great flow of blood into the muscles, and the withdrawal of so large a quantity from the other vessels in the body, causes a fall in the general blood pressure, and a consequent increase in the force and frequency of the heart's beats, so that a more active circulation takes place. Nutritive changes are therefore everywhere increased. A greater amount of waste matter enters the veins, rendering the blood impure. These waste matters stimulate a part of the nervous system concerned with breathing, and lead to an increase in the number and amplitude of the movements of respiration. The same surcharged condition of the blood suffices in a similar way to dilate the vessels of the skin and excite free perspiration. To compensate the heart for this bleeding into the muscles and skin, the

arteries of the belly or abdomen are contracted. Hence the organs lying in that cavity are rendered functionally less active for the time being. This fact points to the impolicy of engaging in severe muscular exercise when digestion is going on—that is to say, for a period of two and a half to three hours after food.

Partly owing to the increase of perspiration, and partly to the contraction of the renal blood-vessels during active exercise, the excretion from the kidneys is diminished. Observations show that any waste matter resulting from muscular work is not thus voided from the body until twenty-four hours have elapsed, and then it bears no proportional relation to the amount of work performed.

In the period which follows violent exercise the blood, after being for a short time surcharged with carbonic acid, becomes, on the other hand, surcharged with oxygen. Contracting muscle needs some oxygen, but the quantity supplied by exercise is much more than is actually required. A man who has just undergone intense and sustained physical work at first breathes hard, then getting his wind his respiration returns to its ordinary rhythm, and eventually it falls below the normal rate. He thus lays up a store of oxygen, which is carried by the blood to all the organs in the body, and stimulates them to greater functional activity. Hence the great value of exercise on nutritive changes generally.

The process by which oxygen is conveyed by the blood to the tissues, and by which carbonic acid is removed by the blood from the organism, is known as Respiration, or more simply Breathing. Air consists of a mixture of 20·96 volumes per cent of oxygen, 79 per cent of nitrogen,

including argon, 0·04 per cent of carbonic acid, and a variable quantity of watery vapour. Oxygen is generally used in the human body in the same way as it is used in fires, for the purpose of causing oxidation or combustion, and thereby developing heat and force. Carbonic acid is a waste product of that combustion. The organs by which oxygen is introduced into the body and carbonic acid removed from it are divided into the air-passages and lungs. The air-passages consist of the nose, gullet, larynx, windpipe, and bronchii. In the nose the air passes over a large expanse of surface rich in blood-vessels and so becomes heated. People who forget this, and breathe through the mouth, are apt to catch cold. The windpipe divides at its lower extremity into two bronchii. These bronchial tubes divide and subdivide throughout the substance of the lung like the branches of a tree, and at length end in irregular cavities, opening into which minute sacs or air-cells cluster in great numbers. The walls of these air-cells are composed of a very delicate membrane, under which ramify a close network of capillaries through which blood is constantly flowing. It has been calculated that if these air-cells were opened out flat they would altogether have a surface area of some 20 square feet. So that the blood distributed over them has a remarkable contact with the air.

Fresh air is drawn into the lungs by the contraction of a dome-shaped muscle—the diaphragm—which forms an arched floor to the chest, and by the contraction of the other muscles of ordinary or extraordinary inspiration already enumerated (p. 27). As the diaphragm flattens itself and so deepens the chest, and the ribs are raised

and so expand the chest, air therefore rushes into the lungs, dilating them. On expiration the muscles relax, and the elastic recoil of the chest-walls and lungs expels the vitiated air. But the lungs are not emptied with each breath. Indeed only a small part of the air in the lungs is expired with ordinary breathing, and even the deepest expiration still leaves a large residual quantity behind. This reserve of air is not changed by any direct act of breathing, but by the law whereby two gases when brought together mix freely, so that the fresh air from without diffuses with that which is already within the lungs.

Atmospheric air enters the lungs with 20·96 per cent of oxygen, and comes into contact with blood in the capillaries. This impure blood has only 16·6 per cent of oxygen. It has lost about 5 per cent in the tissues. But it contains a substance which has a great avidity for oxygen, and yet can only hold the oxygen in combination with it so long as there is a large quantity of free oxygen present around it. In the lungs this condition obtains and the unstable compound is formed. The blood becomes bright red or oxygenated blood. When this aerated blood passes back to the heart and is driven to the tissues, there is no longer an excess of free oxygen around it but the reverse. So the compound breaks up, and the liberated oxygen leaves the blood and enters the tissues to take an active and essential part in the processes of combustion going on there.

One of the great waste products of combustion — carbonic acid—enters and leaves the blood in a similar manner. In the tissues there is too much carbonic acid.

It therefore enters the blood. And in the lungs there is less tension of carbonic acid than in the blood, and the gas is therefore given off and expired from the body.

The number and depth of respirations have practically no direct influence on the oxidation processes in the body or on the formation of carbonic acid, these being regulated by the tissues themselves. But they have a marked effect in the removal of the carbonic acid already formed.

Another waste product—what may be called the soot of combustion—is partly excreted by the lungs. This waste organic matter gives rise to the sickly odour of air vitiated by breathing, and is the dangerous and poisonous element in such impure air. Obviously exercise should be taken out of doors or in a covered place with ample ventilation.

Breathing is largely controlled by the nervous system by means of a self-adjusting apparatus, the centre of which is in a part of the spinal cord (medulla oblongata) where it joins the brain. This Respiratory Centre, as it is called, is particularly sensitive to the quality of blood passing through it. If deficient in oxygen or too rich in carbonic acid, the centre excites the respiratory mechanism to greater activity. If well oxygenated and pure, it calms the movements of respiration. Such impure or venous blood comes from actively contracting muscles, and therefore the respiratory centre is stimulated to increase the number and amplitude of the respiratory movements during violent exercise. Respiratory movements can also be regulated by an effort of the will. We can voluntarily expand the chest in all directions by taking deep inspirations, and vary the rapidity of breathing as we please.

Yet in spite of these physiological clues to the natural methods of developing the chest, it is popularly believed that exercises which move the upper arm at the shoulder-joint and raise the ribs — in short, contractions of the muscles of extraordinary respiration—are the chief means of increasing the capacity of the lungs. On this belief is founded the old-fashioned system of calisthenic exercises, in which drill with elastic chest-expanders forms so prominent a part, and on this belief are based many modern exercises with dumb-bells and bar-balls. But these exercises, however beneficial in increasing the thickness of the chest walls or securing a better deportment of the shoulders, do not much develop the cavity of the chest. To increase the volume of the lungs the primary force must come from within, not from without. No combination of muscular movements can expand the lungs unless the exercises are accompanied by instinctive or by voluntary deep inspirations. If the lungs become affected with consumption, the upper ribs fall in, however well developed the chest muscles are: the consolidated lung does not expand because of an enlarged trapezius and lesser pectoral. In short, strengthening the muscles which can be used for extraordinary respiration is not in itself a means of expanding the chest. It is only when they are being used for forced inspirations that they help in increasing the cavity. And these forced inspirations, whether due to an involuntary hunger for air or to a mere effort of the will, cause the air-cells of the lungs to become fully inflated, and indeed fill out air-cells which are ordinarily inactive. If these deep inspirations are often repeated, the air-cells, whose action has thus been

temporarily solicited, come in the end to be habitually used in ordinary respiratory movements. That is to say, with frequent deep inspirations the lungs permanently increase in their volume and regular capacity for air, and therefore thrust out the chest walls so as to make room for themselves. We blow ourselves out like the frog in Æsop's fable.

The amplitude of respiration, as well as its frequency, is in direct ratio to the intensity of the respiratory need, and the intensity of the need depends on the quantity of mechanical work performed in a given time. Now the quantity of work which a given muscular group can perform in a given time is subordinate to the strength of this group. The legs possess three times as much muscle as the arms, and can produce thrice the quantity of work before being fatigued. Obviously it follows that to increase the chest capacity by instinctive deep inspirations, the exercises which should be engaged in are not expansive movements of the arms but such general exercises of the legs as running, jumping, mountain-climbing, bicycling, going up stairs, skipping drill, and dancing. Amongst pugilists rope-jumping is a common form of exercise to increase the wind. Blacksmiths have seldom as well-developed chests as ploughmen and shore-porters, whose muscular work is more generally severe. In mountaineers the chest is also spacious, partly because of hill-climbing and partly because the air is so rarefied at high altitudes that the requisite amount of oxygen can only be obtained by instinctive deep inspirations.

But violent exercises are only to be undertaken by those in whom there is sufficient strength in the heart to enable it to keep up and work in harmony with the increased

respiratory movements — a mutual capacity popularly known as "wind." And it should be remembered that excessive strain on the lungs may cause the rupture of air-cells and hæmorrhage from the blood-vessels, and either lead to "broken wind" or afford a nest suitable for the germs of disease to develop in. It is notorious that sprint runners die of consumption. The analogy of the frog in the fable must not be carried too far.

The other way of amplifying chest capacity is by voluntary forced inspirations. These direct lung exercises are applicable not only to the well but also to those who from pulmonary trouble or general bodily weakness are unable to undergo the more active general exercises. Dr Otis of Boston points out that they increase the efficiency of respiration without increasing the need of respiration, or, in other words, creating the thirst for air. He has devised many simple yet efficacious exercises of this description. If one stands in a well-ventilated room, or in the open air, with the hands on the hips, and takes long deep inspirations and slow expirations several times a-day, the lung capacity will be materially increased. In these breathing exercises the rhythm can, of course, be varied by altering the depth and duration of inspiration and expiration, somewhat after the manner of the long and short signs of the Morse alphabet. The lungs should be filled from above downwards, the collar-bones being raised, and with them all the ribs, so as to increase the chest capacity to its maximum.

Voluntary forced inspirations lead to the habit of full and deep breathing. Their effect on the expansion of the chest is proved by actual measurements of its circumference, and is exemplified by the well-known circumstance

that public singers and orators are individuals of remarkable chest capacity. Free physical drill and exercises with wands or bar-bells can be made of much more service to the person engaged in them if each movement is accompanied by an appropriate voluntary deep inspiration or expiration. The lungs thus relieve the central organ of the circulation by acting as an accessory heart, and by gaining in capacity increase the aeration of the blood.

The truism that no organ in the body is physiologically isolated is often forgotten in the case of the relations between muscle and brain. And yet it is eternally certain that "the eye cannot say unto the hand, I have no need of thee; nor again the head to the feet, I have no need of you." For muscles are not merely contractile masses of flesh which move the levers of the body, but mechanisms guided by the brain and acted on by organs of special sense, and in turn aiding both of them to perform their functions.

Thus wasting of certain parts of the brain follows amputation of the limbs. Loss of flesh and of contractile power happen after irritative and destroying lesions of particular portions of the spinal cord. And the development of a group of muscles and bones of an entire limb, or of one side of the body, may be arrested by certain forms of central nervous disease which occur in infancy and childhood.

Of even more importance, from the present point of view, than these lesions leading to mutual disaster, is the mutually beneficent relation of muscle and brain. Many of our sensations are dependent on our experience of muscular exertion, and every sensation which is of sufficient

intensity and not hindered by opposing influenees is followed by muscular movement. Our perceptions of the size, shape, and distance of objeets in spaee, and the inertia of material things, are largely due to the assoeiated action of muscles and sense of strain on muscles. These and other associations of similar and dissimilar sensations are a ehief, or, as some hold, the only, source from whieh all our mental aetivities, including logieal thinking, spring. The greater the variety, extent, and intensity of our sensations, the more abundant is the flow of ideas in the brain. The greater the aetivity and edueated sensibility of the muscles in youth, the greater is the mental wealth of later years. For poor slum children there is no book lesson equal to a day in the eountry, where their sensations will be varied and their movements free. Spontaneous actions of a legitimate eharacter ought then to be eneouraged. An exeursion into the country for several days is a part of the orthodox edueation of German sehoolboys.

The stream of sensation does not, as it were, lose itself in quenchless sand, but flows into a responsive soil, which eonverts its energy into fruitful direetions, if the sensation is suffieiently strong and not otherwise prevented. A stimulus applied to any sensitive part of the body is immediately followed by a movement whieh is generally fitted to a purpose. Some of these aetions are perfectly exeeuted as soon as a child is born, as, for example, the movements neeessary for breathing and suckling. Others more gradually aequire a fully developed purposive eharacter, sueh as certain movements of the eye. These Reflex Actions vary in their eomplexity, and accordingly

demand a varying degree of skill in the regulation or co-ordination of the muscles necessary for the action, and yet, so far as is known, this is performed without the guidance of the mind. Indeed they always remain the same with stubborn monotony, irrespective of circumstances, so that they sometimes thereby fail in their purposive character. Thus, for example, the foot on being pricked is drawn up whether the instrument used is applied to the upper surface of the instep or to the sole. There is a customary suitability but no intelligence in the action.

A purely reflex movement is the result of a single stimulus; but when two or more stimuli, acting at once or in close relation to each other, excite the nervous system into muscular response, the movement is called Automatic. These two kinds of movement are often mistaken for each other, yet they are essentially different. The one is a movement which invariably follows a given stimulus, the other a movement which is modified by intercurrent stimuli. Both are purposive in character, but automatic acts are always gradually acquired from acts which are at first distinctly conscious of their object, and only afterwards become almost or quite unconsciously performed. They can not only be excited by the direct stimuli of sense perceptions, but also by the memory of sensual perceptions and their resultant ideas. When an ordinary man is struck by an assailant, the automatic motor actions of a defensive and offensive character are apt to be obvious, perhaps too obvious. When an experienced engine-driver sees a danger-signal ahead, he almost unconsciously stops his locomotive. When a well-trained soldier receives the

order to halt, he does so with the fatalistic precision of a machine. There is no hesitation or thought of an alternative course of action. The influence of an idea in exciting automatic activity is evident when a soldier runs away after the first shot of the enemy. But it is not so apparent in the reason why children should only associate with those whom it will do them no harm to imitate. The mastery of automatism is seen when a soldier receives his baptism of fire and ducks his head, although he may be previously convinced that the bullet has passed before he heard the "hooting" sound: his action was acquired from his experience in avoiding approaching missiles, and has become involuntary. The advantage of automatism is obvious if we walk down-stairs thinking of something else.

When once a sensation or idea produces a given motor action, any subsequent similar sensations or ideas have a tendency to excite a like muscular movement. A road seems to be opened up in the brain, which is afterwards traversed in preference to other possible paths. The sensations and ideas tend to go by rule of thumb. These functionally associated routes are structurally represented in the brain. It is true that the order of development of the anatomical centres for sensation, and of the centres for motion, and of the associating fibres and areas which lie between them, is still the subject of investigation, but it is certain that long after the sensory and motor districts are well differentiated, the connecting convolutions are comparatively simple. This is observed in infants and in the brains of people at the lower end of humanity. The higher we ascend the scale, the more complex do the as-

sociating areas become, although they increase with difficulty after the age of thirty-three.

Whenever an effort is made by an impulse of the will in accordance with the sensory remembrance of a similar movement, an association is formed between the volitional centre and the centre regulating the movement. Every repetition of the voluntary action increases the intensity of the association and the ease with which it is done. It is this bias towards the association of a particular will centre with a particular motor centre which constitutes the Memory of Movements. At first the muscles needed for the performance of any particular act require close attention to be paid to their co-ordination, but each repetition of the endeavour increases the facility of its performance and the intensity of the motor memory, so that less and less conscious attention may be paid to the movement. Accuracy is gradually acquired. Subsequently the rapidity with which the movement can be performed is increased. As the intensity of the motor memory grows, the slightest impulse from the will centre causes the requisite movement. Attention becomes unnecessary for its performance, so that conscious attention can be used for other purposes. Automatic action is therefore the result of the memory of movements which have, in the first instance, been learned. Indeed only when the association can be automatically performed can a movement be considered to be thoroughly learned. Practice alone makes perfect automatism. Thus a violinist may play a complicated piece of music while thinking of other things, an expert horseman may sleep in the saddle, and a bicyclist engaged in long-distance

record-breaking may be scarcely awake during portions of his journey.

Indeed the mechanical perfection of a movement generally varies with the degree to which the effort is automatic, for it is then less likely to be interfered with by disturbing influences. A man often does a thing best when he almost forgets what he is doing. A golfer makes better practice when the calculation of his stroke is subconscious than when he endeavours to voluntarily direct every stage of the complex mental and muscular acts involved.

All voluntary movements should be cultivated so as to make automatism possible for obvious advantages in daily life. Automatism saves time and energy, and is of extreme use under trying emergencies when he who hesitates is lost. It is little short of a necessity to private soldiers if they are to be of value as a disciplined fighting machine.

It should be borne in mind that those actions in which the preservation of equilibrium forms a part are more difficult to learn, and are far more likely to become disabled, than those which have not this factor. Dancing is more easily forgotten than swimming.

One of the functions of association is essentially concerned with the formation of our habits. For Habit is but the process of associating a definite muscular action with a certain sensation or idea; in other words, it is the tendency to use a beaten highway in the brain with no thought of any other. It has thus the advantage of largely converting us into automatic machines, leaving our consciousness free for the pursuit of other objects.

It has the advantage or disadvantage of making us the slaves of our youthful selves, for the plasticity of nervous matter to the formation of these associated tracts passes away after early manhood, and fresh habits are not easily acquired. Hence it is of prime importance to accustom young people to associate correct motor responses with given sensations and ideas, so that there will be no conscious dubiety of the easiest course of action. Habits of orderliness and discipline, habits of precision and grace of movement, and many other habits, arise more from early training than from any subsequent effort of the will. For the act of doing results in a changed physiological disposition, which is the true royal road to learning. And happy is the child who learns how to do a thing before he can appreciate the reason why.

From earliest life every sensation tends to the production of mechanical motion, and later on mere ideas of concrete things have also a like effect to a varying extent, some exciting it more than others. On this susceptibility rests the faculty of Imitation. A concrete instance always appeals more easily to the mind than the mere suggestion of an idea containing a motor element. Example is better than precept. Consequently physical exercises should be demonstrated to pupils, great care being taken that unintentional movements are not incidentally given to be copied. Since it is through sight that imitation chiefly works, the movements to be executed ought to be closely followed by the eyes, and attention should not be distracted by accompanying verbal explanations.

Now, while direct sensations and recollected sensations

originate purposive aetions, other ideas started in the mind by association may exeite movemcnts opposed to the first,—that is to say, the play of motives begins to operate. A given tendency to movemcnt may be antagonised by another, so that no apparent aetion results. This equilibrium of motives is known as Inhibition or Self-Control. When a boy sees a pear over his neighbour's wall, the visual sensation instantly suggests the luseiousness of the pear and the sweetness of stolen fruit. These ideas urge him as a natural boy to seize and taste it. But as a moral boy, or as a boy with a due appreeiation of eivil eonsequences, he reflects on the iniquity of theft or on the long arm of the law. These later ideas lead to a grievous eonflict with the first and happier thoughts, and the moral boy of this illustration has his intended aetion resolved into no action at all—the positive motive is paralysed by the negative one.

By thus exercising an inhibitory power over the muscles, it is possible to stifle, or at all events to lessen, the violence of an emotion. The stimulation of a schoolboy's hand with a cane or other weapon produces no reflex shrinking if the boy has any sense of scholastie honour. And in after-life the inhibition of emotion is generally recognised as a sign of manliness and soeial breeding. This restraint over the expression of emotions varies in its effieiency with the power the will has to eontrol our museular actions. Therefore, as systematic museular exercise at word of command develops the responsivcness of the muscles to the aetion of the will, the value of such training for inhibitory purposes is obvious. This is becoming recognised in certain institu-

tions for the treatment of criminals and in asylums for the insane. But it is equally applicable to the healthy, and is of especial advantage to growing children and young soldiers. Now that ships are mastless, the use of physical drill in bringing bluejackets to discipline is hard to overestimate.

The possible alternative courses of action on the receipt of a given stimulus can be so educated into an automatic preference that it is performed immediately and unconsciously. Thus it is possible to acquire correct habits both of external action and of self-control. Now, action is the index of character—the difficulty in estimating the character of our neighbour being a full knowledge of his motives. In trying to form or reform character, we should have an accurate acquaintance with the sensory and ideational stimuli most likely to produce the desired effect. This also is the secret of oratory—the suggestion of stimuli which tend to cause action in a designed direction and the suppression of others. Thus, for example, the memory image of a movement is apt at once to arouse the movement itself.

Those are not the only advantages of physical drill in the education of the nervous system. The habit of waiting for a word of command produces an attitude of expectancy which stimulates the attention, while physiologically bracing the muscles, making them both more ready to act and more efficient in their action. The faculty of combining or co-ordinating the motions of associated groups of muscles is improved. By careful exercise the muscular sense also is better developed; that is to say, the capacity for receiving sensations which

lead to ideas, and are a basis of intellectual acquirements and reasoning, is perfected.

Since gymnastic exercises increase the force of the muscular act, it is clear that the force of the will for these particular acts must also be absolutely or relatively increased. This action of the will on muscular effort varies according to what we hear, feel, or see. Intellectual excitement increases the power of the muscles. Athletes often surpass their previous efforts in public competitions.

The influence of Music on the energy of voluntary action is well known. Just how much of the effect is due to the rhythm, tune, melody, and harmony has not been determined, but a very great deal depends on the pitch. Tones of moderate pitch increase the power of the muscles, whereas very high or very low tones weaken it. In the ancient modes of music, where pitch was distinctive, Dorian was considered the music of courage. In modern music the best effect on muscular energy will probably be obtained by selecting such a key as involves only the use of notes which would be considered of moderate pitch for the voice. On the piano this may be done by choosing an octave of medium register. Marches are especially useful.

With the object of thus Drilling the Nerve Centres, these centres should not be taxed with other efforts at the time of exercise. Attention ought to be strictly concentrated on the work done. Therefore no distractions from the business in hand should be permitted. And the muscles must not be burdened with heavy weights. Although since slight resistance to a given action will

improve the co-ordination and rapidity of the movement, it is often advisable to use some voluntary resistance to a given action, or light weights, such as bar-bells.

Now, any system of physical training adapted to the conjoint education of the muscles and mind must follow the indications given by development. Without entering into the anatomical and physiological complexities of such a subject, it may be briefly stated that those motor functions which man possesses in common with the lower animals are to be regarded as fundamental muscular movements, and that those which have been superadded in the course of evolution, and which differentiate man from the highest of the lower animals, are accessory or more lately developed movements. Both from an organic and from a functional point of view this order of growth is adhered to. A plan of drill should therefore provide, first of all and continuously, for the training and exercise of the fundamental muscular mechanisms, so far as this is possible. Any system which trains the more lately developed muscular movements to the neglect of the primary ones, or attempts their training out of the proper order of their ripening, is brain-forcing, and may be attended with disastrous results. It is of course impossible to completely separate each function involved. Classifications into natural orders are seldom absolutely exclusive. The relation of functions in the human body is too intimate to make them altogether independent of each other. They run into one another, but, broadly speaking, the dividing lines should be preserved.

A provisional system of exercise may therefore be drawn

up on the physiological and psychological basis of this developmental plan.

Reflex and hereditary automatic actions are present at birth. The movements necessary for circulation, respiration, and nutrition commence with separate life. Those for nutrition alter as a human being grows older. Exercise must therefore primarily concern itself with the muscular movements beneficial to the circulatory and respiratory mechanisms.

Apart from general bodily exercises which affect the action of the heart, the circulation in the muscles may be solely influenced by a series of resisted movements, which are identical with ordinary free exercises in the character of the movements performed, but differ in that they are resisted with a slightly inferior force by an attendant or suitable apparatus. The movements are not allowed to accelerate the breathing, and no movement should be repeated twice in succession in the same limb or group of muscles. By causing a flow of blood into the muscles, they increase the arterial circulation, diminish the work of the heart, and accelerate the return of venous blood, thereby strengthening the heart and improving the circulation generally. These are correctly known as Swedish Movements—a term often misapplied to ordinary free exercises.

To increase the capacity of the Lungs, the chief method is by the instinctive deep breathing which accompanies violent muscular exercise of an extensive area. But special pulmonary gymnastics consist of voluntary respiratory efforts, in which the breathing is varied in every conceivable way with regard to depth, sequence, and

rapidity. In all physical drill regard should be had to appropriate deep inspirations and expirations accompanying the movements.

Simple exercises of Co-ordination and the development of the Lower Automatic Motions are included in the fundamental movements of physical culture. These may be made up of such lessons as instructions in correct deportment, company drill, marching, and figure-marching.

The Muscular Sense may also be improved with exercise. Other Sense Perceptions, such as sight and touch, may be educated. For very young children, the best physical instruction of this nature they can have is to be left to themselves. They should neither be helped too much nor hindered more than is necessary in their actions. The best teacher is the book of nature. But for older children many exercises may be devised for the education of their sense-perceptions. These might be called Kindergarten Exercises. Juggling with balls, the judgment of heights and distances, and the estimation of weights, may be used. A "tug of war" is a familiar exercise on the inertia and active resistance of certain objects.

Inhibition exercises are of frequent occurrence in many forms of physical drill. But the only specialised exercise on inhibition in general employment is that of sudden halts being made in marching and running drills. It might be possible to devise other methods equally free from danger. Social exercises are frequent.

The movements distinctive of man are next to be dealt with. Of these the act of Prehension is first developed. It is therefore convenient in this connection to deal with

simple exercises of the Upper Limbs. Highly specialised movements of the hands and fingers are of course of later growth. These simple drills may consist of regulated movements of the arms. In addition to these Free Exercises, Wands, Bar-Bells, and light dumb-bells may be employed. Exercises on Prehension might include holding on to bars or rings and catching balls. Swinging on a single rope is a favourite amusement with children.

To maintain the erect position of the body, muscular action affecting the spinal column and lower extremities is essential. One of the earliest of these movements is contraction of the muscles, drawing the upper third of the spine forwards. The usual Trunk Exercises consist in bending the trunk forwards, erecting it, bending it backwards, leaning it to one side or the other, and rotating it. These are generally executed as free movements, although it is possible to employ light weights in connection with some of them.

Balancing exercises come next in order. The pupil stands on one or both feet in various positions. In the basket marching drill of the Italians the exercises must be entirely subservient to the erect bearing necessary for balancing the basket on the head, so that a gracefulness of carriage is acquired equal to that of the women water-carriers of the East.

Movements of the Lower Extremities consist of flexions and extensions of the entire limbs, or combined movements of flexion of one part with extension of the other, and abductions, adductions, and rotations of the hip-joints. Lunging and running ought to be included in these

exercises. In an infant this is the stage when the act of walking is developed.

A full course of bar-bells or wooden dumb-bells has two objects to attain. The one is the co-ordination of muscles and nerves so as to secure grace and precision of movement, accuracy of rhythm, and consecutiveness of action; and the other is the selection of exercises which shall equally train the muscles of the arms, trunk, and legs, and not of the upper extremities alone.

Climbing and jumping, although by no means characteristic of man, whatever they may be of small boys, are the next exercises in order of growth, because they represent a still higher degree of co-ordination. They are, in fact, the approach to highly specialised exercises. For the education of the nerve centres, these exercises are not so beneficial as they are for the development of muscle, owing to the amount of physical energy required in most of them. Simple vertical ropes, and vertical ropes beaded at intervals with balls, are used for climbing, as are also poles, ladders, planks, and prepared walls. High jumping and vaulting over a bar or horse are regularly performed in a gymnasium. These are not suitable for very young pupils, who find a much better exercise in the various forms of skipping drill.

General exercises on the horizontal and parallel bars, rings, and trapese, are chiefly good for muscular development.

But in senior pupils the nerve centres can be particularly well educated with such highly specialised exercises as Indian Clubs, Bayonet Exercise, Sword Drill, Fencing, Boxing, and Dancing. On physiological grounds these

very highly specialised exercises should not be taught to young children. For this reason it is questionable if the intricate finger movements requisite for pianoforte-playing should be attempted at an early age.

The peculiarity known as Right or Left Handedness is a unilateral predominance due to the circumstance that both sides of the brain are not equally used. Most of us trust to the left half of our brains, and are therefore right-handed. By cultivating an ambidextrous habit we should be the better fitted for the emergencies of our occupations and of cerebral disease. This training may be best accomplished by Free Exercises involving the separate action of each hand, by Ball Drill, and by Indian Clubs.

In conclusion, it might be interesting to describe the abnormalities of exercise itself: the round back of the bicyclist; the bow-legs of the equestrian; the warping of the shoulders forwards, with over-development of the extensor muscles and neglect of the flexors, of the oarsman; the one-sided exercise of the swordsman, and its tendency to produce lateral curvature of the spine; and the exaggerated shoulders, slender legs, and round back of many a professional gymnast. It would enter too much on medical spheres to, then, deal with the treatment of bodily defects and disease by exercise. Sufficient will have been written if the reader is enabled to answer intelligently the teleological question, "What is man's chief end in exercise?" with the time-worn adage, *Mens sana in corpore sano.*

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PART II.

PHYSICAL EXERCISES (OR DRILL)

BY

ALEXANDER STURROCK

GENERAL DIRECTIONS TO TEACHER.

1. *Instruction of Pupils.*—The teacher must be clear, firm, and concise in giving directions and explanations. Allowance should be made for the different capacity of pupils, and patience exercised when endeavour and goodwill are apparent. Pupils should fully master one part of their drill before they proceed to another. When first taught their positions, they should be properly placed by the teacher: when more advanced, they should not be touched, but taught to correct themselves when admonished.

2. *Duration of Lessons and Drills.*—Pupils should not be kept too long at any one exercise during drill. The drills also should be short and frequent, lest the attention of the teacher and pupil is fatigued.

3. *Words of Command.*—Every command must be distinctly pronounced, and sufficiently loud to be heard by all concerned. The first part of a command warns the pupils of the nature or extent of the order to be given, and is known as the *Caution.* It should be pronounced slowly and distinctly. The second part commands the action to be performed: it is the *Executive* order, and should be uttered sharply and quickly—*e.g.*, *Right-Turn*, and *Squad-Halt.* When this last word of a caution is the signal for any preparatory movement, it must be given as an executive word, and separated from the rest of the command by a pause, as though there were two separate commands, each

with its caution and executive word—*e.g.*, *Right-Turn*, *Quick-March*.

When the pupils are in motion, executive words must be completed as they are commencing the pace which will bring them to the spot on which the command has to be executed. The cautionary part of the word must therefore be commenced accordingly.

N.B.—The words in the margin printed in heavy type are the commands to be given by the teacher.

DEFINITIONS.

Rank. A line of pupils side by side.

File. A row of pupils standing in a line one behind the other.

Front. The direction in which pupils face when occupying the same relative positions as when last numbered—*e.g.*, facing the teacher at first.

Interval. The lateral space between pupils or groups.

Distance. The space between pupils or bodies of pupils from front to rear.

Depth. The space occupied by a body of pupils from front to rear.

Dressing. The operation of forming a straight line of pupils in a rank on a given point—*e.g.*, to right or left flank.

Covering. Arranging a straight line one behind the other as in file.

Closing. Pupils in a line moving sideways to the right (or left) so as just to touch the neighbouring right (or left) -hand pupil with the elbow when the arms are hanging down.

Right. Is the right hand of a line of pupils facing front —*i.e.*, not of the teacher.

Flanks. The ends of a line.

ARRANGEMENT OF CLASS.

FORMATION OF A SQUAD.

In Single Rank or Two Deep without Intervals.

Fall in—In single rank or two deep.

The pupils will be placed in line—*i.e.*, side by side, facing the front. The right-hand pupil being placed first, the remainder will fall in line one after the other, closing lightly towards the right, turning the elbow slightly outwards so as just to feel the pupil to the right. Each pupil is allowed a space of 24 inches when there is nothing in the hands, and 27 inches if bar-bells, &c., are carried. In the latter case four pupils occupy rather less than 3 yards.

If the space is insufficient to accommodate all the pupils in one rank, equal ranks in two deep may be formed. Each rear-rank pupil will be placed 60 inches from the pupil in front of him (or her), measuring from heel to heel, and will cover him (or her) correctly, so as to form a straight row or file. When a squad of two ranks consists of an uneven number of pupils, the third pupil from the

left of the front rank will be a *blank* (or incomplete) *file*, and have no one behind him (or her).

POSITION OF THE PUPIL.

Squad—Attention.

On the word *Attention*, the shoulders and body of each pupil are to be brought squarely to the front. The heels must be in line and closed; the knees straight; the toes turned out, so that the feet may form an angle of 45 degrees. The arms should hang easily from the shoulder, elbows to the rear, slightly bent, the hand partially closed, the backs of the fingers touching the thigh lightly, thumb close to forefinger, the hips rather drawn back, and the breast advanced, but without constraint. The body should be straight and inclining forward, so that the weight of it may bear principally on the fore part of the feet; the head erect, but not thrown back, the chin slightly drawn in, and the eyes looking straight to the front (*vide* fig. 7).

FIG. 7.

NUMBERING.

Number.

The squad will be numbered from right to left, each pupil calling out his or her number in succession. The centre of the squad is the pupil or file on the left of the right half of the squad.

SIZING.

Sizing in Two Ranks.

A company will be sized as follows :—

Size in single rank, tallest on the right, shortest on the left.

Number : odd numbers one pace forward, even numbers one pace step back—March.

Ranks, right and left—Turn.

Form company, quick—March.

Having arranged the pupils in single rank according to their heights, tallest on the right, shortest on the left, direct the company to number, and then order the odd numbers to take a pace forward and the even numbers to step back a pace. Cautioning No. 1 to stand fast, give the command *Ranks, right and left—Turn*, upon which the front rank will turn to the right, the rear rank to the left. Then on the words *Form company, quick—March*, No. 3 forms up in rear of No. 1, No. 5 halts and fronts on the left of No. 1, No. 7 forms in rear of No. 5, and so on, the rear rank wheeling round to the right and following the left-hand pupil of the front rank, the leading pupil (or the second pupil, if there is an incomplete file in the right half company) halting and fronting as the right-hand pupil, rear rank, of the left half company, the next pupil forming in front of him (or her), and so on. The blank file, if there be one, to be placed the third from the left.

Sizing in Single Ranks.

As above, but stop at word *Number*, or at the words *Form company, quick-march*, substitute the words *Form single rank, quick-march.* No. 3 forms on the left of No. 1, No. 5 on No. 3, and so on, the highest even number forming on the left of the highest odd number, so that No. 2 becomes the left-hand pupil.

N.B.—This is sufficient for most classes.

DRESSING WHEN HALTED.

Eyes—Right. On the word *Right* (or *Left*), each pupil will look towards the flank (or end of the line) by which he (or she) is ordered to dress, with a smart turn of the head in that direction.

Dress. On the word *Dress*, each pupil must move with short quick steps without bending backward or forward, the shoulders being kept perfectly square as in attention, until he (or she) is just able to distinguish the lower part of the *face* of the second pupil to the right beyond him (or her).

Eyes—Front. When the teacher is satisfied that the line is correct, he (or she) will give the command *Eyes—Front*, on which the pupils will turn their heads and eyes smartly to the front.

STANDING AT EASE.

Pupils will first be taught the motions of standing at ease by Numbers, then judging the Time.

1. By Numbers.

Caution.—*Stand at Ease, by Numbers.*

One. On the word *One*, raise the arms from the elbows, left hand in front of the centre of the body as high as the waist, palm upwards; the right hand as high as the right breast, palm to the left front; both thumbs separated from the fingers, and the elbows close to the sides.

Two. On the word *Two*, strike the palm of the right hand on that of the left, drop the arms to their full extent, keeping the hands together, and passing the right hand over the back of the left as they fall; at the same time draw back the right foot 6 inches, and slightly bend the left knee (*vide* fig. 8).

Fig. 8.

When the motions are completed, the arms must hang loosely and easily, the fingers pointing towards the ground, the right thumb lightly held between the thumb and palm of the left hand; the body must incline forward, the weight being on the right leg, and the whole attitude without constraint.

N.B.—When the pupil falls in for instruction he (or she) will be taught to place himself (or herself) in the position above described.

Squad, Attention. On the word *Attention*, spring up to the position described in paragraph on Attention.

2. Judging the Time.

Caution.—*Stand at Ease, Judging the Time.*

Stand at—Ease. On the word *Ease,* go through the motions described in the standing at ease by Numbers, distinctly but smartly, and without any pause between them.

Squad, Attention. As before.

If the command *Stand at—Ease* is followed by the word *Stand Easy,* the pupils will be permitted to move their limbs, but without quitting their ground, so that on coming to *Attention* no one shall have materially lost his (or her) dressing in line. If pupils are required to keep their dressing accurately, they should be cautioned not to move their left feet.

On the word *Squad* being given to pupils standing easy, they will at once assume the position of standing at ease.

TURNINGS.

A. Military Turnings.

These should be done at first with numbers, and afterwards by judging time.

In going through the turnings, the left heel must never quit the ground; but the pupil must turn on it as on a pivot, the right foot being drawn back to turn the body to the right, and carried forward to turn it to the left: the body must incline forward, the knees being kept straight.

In the first of all the following motions, the foot is to be carried back, or brought forward, without a jerk, the movement being from the hip; so that the body may be kept perfectly steady until it commences to turn.

Right—Turn. On the word *Turn*, place the hollow of the right foot smartly against the left heel, keeping the shoulders square to the front.

Two. On the word *Two*, raise the toes, and turn a quarter circle to the right on both heels, which must be pressed together (*vide* fig. 9).

Left—Turn. On the word *Turn*, place the right heel against the hollow of the left foot, keeping the shoulders square to the front.

Two. On the word *Two*, raise the toes, and turn a quarter circle to the left on both heels, which must be pressed together (*vide* fig. 10).

About—Turn. On the word *Turn*, place the ball of the right toe against the left heel, keep the shoulders square to the front.

Two. On the word *Two*, raise the toes, and turn to the right about on both heels.

Three. On the word *Three*, bring the right foot smartly back in a line with the left (*vide* fig. 11).

Half right (or left)—Turn. On the word *Turn*, draw back (or advance) the right foot one inch.

Two. On the word *Two*, raise the toes, and turn half right (or left) on both heels (*vide* figs. 12 and 13).

Quarter right—Turn. On the word *Turn*, raise the toes, and turn a quarter right on both heels.

Three-quarters right about—Turn. Make a three-quarters turn to the right about in the same manner as in turning about (*vide* fig. 14).

Two.

Three.

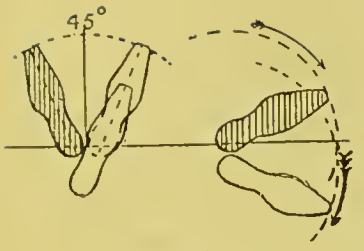


FIG. 9.

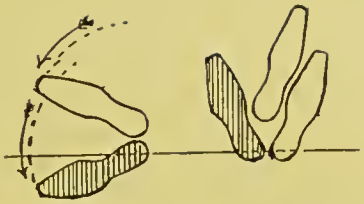


FIG. 10.

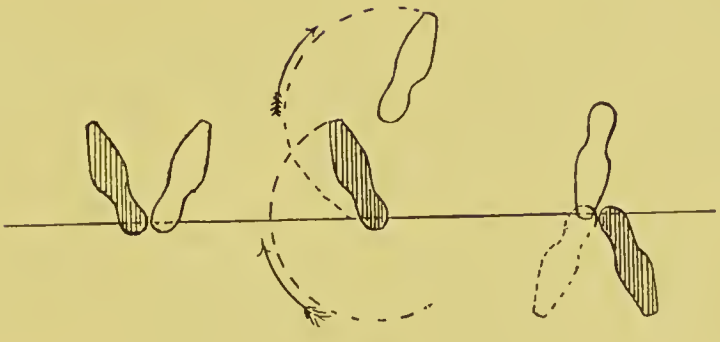


FIG. 11.

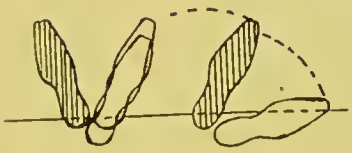


FIG. 12.

FIG. 13.

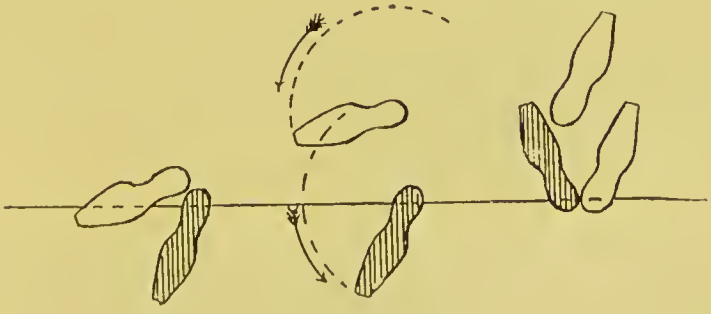


FIG. 14.

Three-quarters left about—Turn. On the word *Turn*, place the right heel against the ball of the left toe, keeping the shoulders square to the front.

Two. On the word *Two*, raise the toes, and make a three-quarter turn to the left about on both heels.

Three. On the word *Three*, bring up the right foot smartly in a line with the left.

Squad—Front. After any of the foregoing turnings, the whole *Front* may be given, on which the whole will turn, as accurately as possible, to their former front.

When the pupil has previously turned about, he (or she) will always front by the right about. But if he (or she) has turned to the three-quarters right about, he (or she) will front by the three-quarters left about, and *vice versâ*.

B. Swedish Turnings.

These are done in two counts.

Right—Turn. On the word *Turn*, the pupil rises on the toe of the left foot and the heel of the right, and turns to the right a quarter circle.

Two. On the word *Two*, the pupil advances the left foot to the heel of the right foot, coming to attention.

Left—Turn. On the word *Turn*, the pupil rises on the toe of the right foot and heel of the left foot, and turns to the left a quarter circle.

Two. On the word *Two*, the pupil advances the right foot to the heel of the left foot, coming to attention.

Turning may be done in this way to right or left to the various divisions of a circle.

Right or left half turn	is $\frac{1}{8}$ of a circle.
Right or left turn	is $\frac{1}{4}$ " "
Right or left $\frac{3}{8}$ turn	is $\frac{3}{8}$ " "
About turn (always to the right)	is $\frac{1}{2}$ " "

C. Original Method of Turning.

This is the simplest method of turning. It must, however, be done with precision and smartness. It is done in one count.

Right—Turn. On the word *Turn*, the pupil turns on the heel of the right foot a quarter circle to the right, at the same time bringing the left foot smartly to the position of attention.

Left—Turn. On the word *Turn*, the pupil turns on the heel of the left foot a quarter circle to the left, at the same time bringing the right foot smartly to the position of attention.

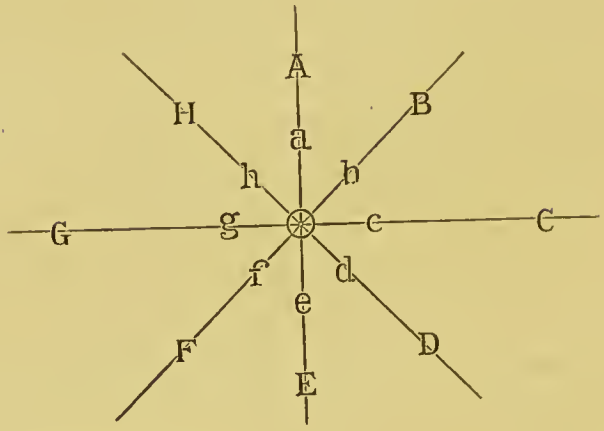
The other turnings are done in a similar manner.

D. Turning in Lunging Positions.

Right about—Turn. On the word *Turn*, the pupil draws back the right foot one pace and turns on both heels to the right a half circle, and brings the front of both feet smartly to the ground.

Left about—Turn. Can be done in a similar manner, substituting the left for the right foot in making the backward pace and turning to the left.

DIAGRAM OF POSITIONS.



All the steps and lunges given in this book are indicated in the above diagram. In the initial position the pupil is supposed to stand in the centre of the diagram facing *A*, and all movements refer throughout to this initial position.

Thus "Lunge to D," "Step to F," always mean movements involving certain fixed directions with respect to the starting-point, no matter how the pupil may face in the movement immediately preceding.

A "Step" is to be considered as half the length of a "Lunge."

PRELIMINARY MARCHING DRILL.

Length of Pace.

In slow or quick time the length of a pace is 30 inches, except in "stepping out," when it is 33 inches, and in "stepping short," when it is 21.

In "double time," the length of a pace is 33 inches.

The length of the side step is $13\frac{1}{2}$ inches.

N.B.—When a pupil takes a side pace to clear or cover another, as in forming four deep, the pace will be 27 inches.

Cadence.

In slow time, 75 paces are taken in a minute. In quick time, 120 paces, making 100 yards in a minute. In double time, 165 paces, making 151 yards 9 inches in a minute.

Position in Marching.

In marching the pupil must maintain the position of the head and body as directed in p. 75. He (or she) must be well balanced on his (or her) limbs. The arms and hands must be kept steady by the sides, care being taken that the hand does not partake of the movement of the leg. The movement of the leg must spring from the haunch, and be free and natural.

Both knees must be kept straight, except while the leg is being carried from the rear to the front, when the knee must necessarily be a little bent to enable the foot to clear the ground. The foot must be carried straight to the front, and, without being drawn back, placed softly on the ground so as not to jerk or shake the body; the toes turned out at the same angle as when halted.

Although several pupils may be drilled together in a squad

with intervals (*vide* Extension Drill, No. A 2), they must act independently and precisely as if they were being instructed singly. Each pupil must be taught to march in a straight line, and to take a correct pace, both as regards length and cadence, without reference to the other pupils of the squad.

Before the squad is put in motion, the instructor will take care that the pupils are square individually and in correct line with each other. Each pupil must be taught to take up a straight line to his (or her) front, by first looking down the centre of his (or her) body between his feet, then fixing the eyes upon some object on the ground straight to his front at a distance, and also at an intermediate point.

Balance Step.

The object of the balance step is to teach the pupil the free movement of the legs, preserving at the same time perfect squareness of shoulders and steadiness of body. No labour must be spared to attain this object, which forms the very foundation of correct marching. The instructor must be careful that the pupil keeps the body well forward, and the shoulders perfectly square during these motions.

1. *Advancing.*

Caution.—*Balance Step advancing.*

Front. On the word *Front*, the left foot will be raised from the ground and carried smartly to the front, the knee being straightened as the foot is carried forward, toes turned out at the same angle as when halted, the sole parallel to, and about 2 inches from the ground, the heel about 12 inches in advance of the line of the right toe.

Forward. As soon as the pupils are steady in the above position, the word *Forward* will be given, on which the left foot will be placed firmly on the ground at 30 inches distance from heel to heel, toes turned out at the same angle as when halted; and the right foot will immediately be raised and held extended to the rear, the toe pointing to the spot on the ground it has just quitted, both knees to be kept straight.

Front. On the word *Front*, by a slight bend of the knee the right foot will be brought smartly forward, and so on alternately.

Squad—Halt. On the word *Halt*, which should always be given when the moving foot is to the front, that foot will complete its pace, and the other will be brought up smartly in line with it.

2. *Retiring.*

CAUTION.—*Balance Step retiring.*

Rear. On the word *Rear*, the left foot will be raised from the ground and carried 12 inches to the rear, the toe pointing to the ground; toes turned out at the same angle as when halted, both knees to be kept straight.

Retire. As soon as the pupils are steady in the above position, the word *Retire* will be given, on which the left foot will be brought to the ground at 30 inches from heel to heel, the right foot will be immediately raised, and held extended to the front, as described in the command *Front* in the *balance step advancing.*

Rear. On the word *Rear*, carry the right foot to the rear, as directed for the left, and so on alternately.

Squad—Halt. On the word *Halt*, which should always be given when the moving foot is to the rear, that foot will complete its pace, and the other will be brought back smartly in line with it.

Great care must be taken that the toes remain throughout at the proper angle; that the body accompanies the leg, and that the inside of the heel is placed on the straight line that passes through the points on which the pupil is marching; that the body remains straight, but inclining forward; that the head is erect and turned neither to the right nor left.

The Slow March.

The three most important objects in this part of the drill are cadence, length of pace, and direction. (For Music, *vide* p. 201.)

Slow—March. The time having been given on the piano, on the word *March*, the left foot will be carried 30 inches to the front, as directed above, the right foot will be then carried forward in like manner, and so on alternately.

The pupil must be thoroughly instructed in this step, as an essential preparation for arriving at accuracy in the paces of greater celerity.

Whenever the word *March* only is given, without the time being prefixed, slow time is implied.

The Halt.

Squad—Halt. On the word *Halt*, the moving foot will complete its pace, and the rear foot be brought up in line with it.

It is an absolute rule that after the word *Halt*, the pupils, whatever their position, will stand perfectly steady, unless ordered to dress.

Stepping Out.

Step—Out. When marching in slow time, on the words *Step—Out*, the pupil will lengthen his pace to 33 inches by leaning forward a little, but without altering the cadence.

This step is used when a slight increase of speed, without an alteration of cadence, is required; on the words *Slow—Step* the pace of 30 inches will be resumed.

Stepping Short.

Step—Short. On the words *Step—Short*, the foot advancing will finish its pace, and afterwards each pupil will take paces of 21 inches until the word *Forward* is given, when the usual pace of 30 inches will be resumed.

This step is used when a slight check is required.

Marking Time.

Mark—Time. On the words *Mark—Time*, the foot then advancing will complete its pace, after which the cadence will be continued, without advancing, by raising each foot alternately about 3 inches from the ground, keeping the body steady; on the word *Forward*, the usual pace of 30 inches will be resumed.

From the halt, the word of command will be *Slow Mark—Time.*

Stepping Back.

Step—Back. In stepping back, pupils must be taught to take pace of 30 inches straight to the rear, preserving their shoulders square to the front and their bodies erect. On the word *Halt*, the foot in front will be brought back square with the other.

A few paces only of the step back can be necessary at a time.

Changing Step.

Change—Step. To change step in marching, the advancing foot will complete its pace, and the ball of the rear foot will be brought up quickly to the heel of the advanced one, which will instantly make another step forward, so that the cadence will not be lost, two successive steps being taken with the same foot.

This may be required when a single pupil is stepping with a different foot from the rest.

The Quick March.

The cadence of the slow march having become perfectly familiar to the pupil, he (or she) will be taught to march in quick time. (For Music, *vide* p. 202.)

Quick—March. The time having been given on the piano, on the word *March*, the squad will step off together, with the left foot, observing the rules given above.

When a pupil is perfectly grounded in marching in quick time, all the alterations of step, and the marking time, and changing step, laid down for the slow march will be practised in quick time.

The Side Step.

Pupils will first be taught the side step by numbers, then judging the time.

1. *By Numbers.*

Caution.—*Right Close, by Numbers.*

One. On the word *One*, the right foot will be carried 13½ inches to the right, the shoulders and face being kept perfectly square to the front, and the knees straight.

Two. On the word *Two*, the left foot will be closed smartly to the right foot, heels touching.

One. The word *One* being repeated, the right foot will be carried on 13½ inches as before described, and so on.

Squad—Halt. When the word *Halt* is given, the left foot will be closed to the right, as on the word *Two*.

2. *Judging the Time.*

Caution.—*Right Close, judging the Time.*

Right Close, Quick—March. On the word *March*, each pupil will carry the right foot 13½ inches direct to the right, and instantly close the left foot to it, thus completing the pace; he (or she) will proceed to take the next pace in the same manner: shoulders to be kept square, knees not bent; the cadence is that of quick time. The direction must be kept in a straight line to the flank.

Squad—Halt. On the word *Halt*, the pupils will complete the pace they are taking, and remain steady.

Pupils will be practised in closing to the left by numbers, and judging the time in like manner.

Pupils will also be practised in taking any given number of paces to either flank, and then halting without word of command; the command to be given thus, *Three paces Right Close, Quick—March.*

Turning when on the March.

Pupils will be practised in turning to the right or left, in making a quarter or half turn to the right or left, and in turning to the right or left about, on the march.

1. *Turning to the Right and then to the Front.*

Right—Turn. On the word *Turn*, which should be given as the left foot is coming to the ground, each pupil will turn in the named direction, and move on at once, without checking his pace.

Front—Turn. On the word *Turn*, which should be given as the right foot is coming to the ground, each pupil will turn again to the front, and move on without checking his pace.

2. *Turning to the Left and then to the Front.*

Left—Turn. Pupils will turn to the left in like manner, the word *Turn* being given as the right foot is coming to the ground; after which they

Front—Turn. will turn to the front, the word *Turn* being given as the left foot is coming to the ground.

A pupil will always turn to the right on the left foot; and to the left on the right foot. If the word *Turn* is not given as the proper foot is coming to the ground, the pupil will move on one pace more and then turn.

3. *Making a Quarter or Half Turn to the Right or Left.*

Pupils will also be practised in making a quarter or half turn to the right or left, and then moving on (without checking their pace) in a diagonal direction, taking up fresh points, at once, to march on, keeping their shoulders parallel with those of the pupils on their immediate right or left.

4. *Turning to the Right or Left about.*

Pupils will also be taught to turn about on the march, which must be done by each pupil on his or her own ground, in three paces, without losing the cadence. Having completed the turn about, the pupil will at once move forward, the fourth pace being a full pace as before.

In turning about, when marching in double time, the hands will be dropped to the side on the word *Turn*, and raised again on the completion of the turn.

EXTENSION DRILLS.

A. Extending in Single or Double Rank.

1. *In a Confined Space.*

To half intervals—Extend or Prove distances.

On the word *Extend*, the pupil places the right hand on the right hip, fingers to the front and thumb to the rear, and takes a side step to the left, so that the right elbow just touches that of the pupil on the right. Number one standing fast.

2. *In a Free Space.*

To full intervals—Extend or Prove distances. On the word *Extend*, the pupil extends the right arm to the side, at right angles to the body, and takes side steps, so as just to touch the left shoulder of the pupil on the right. Number one standing fast.

B.—Extending by Threes.

Extend by threes—Number. This is done in single line.

On the word *Number*, the line of pupils number from the right 1 2 3, 1 2 3 alternately.

Number Ones, stand fast; Number Twos, one (or two) paces forward; Number Threes, step back—March. On the word *March*, Number Twos, stepping off with the left feet, take one (or two) paces to the front, coming to attention by bringing the rear feet to the front. Number Threes, stepping off with the right feet, take one (or two) paces to the rear, coming to attention by bringing the front feet to the rear.

N.B.—If two paces are taken, the action is completed in three beats.

C.—Extending from Two Deep.

1. *In a Free Space.*

This is a good method for bar-bell exercise, Indian clubs, or sword exercise, if the pupils take a quarter turn to right or left when in the extended position.

Number. On the word *Number*, the front rank numbers 1 and 4, 1 and 4 alternately, and is

followed by the rear rank numbering 7 and 11, 7 and 11 alternately, from right to left.

Number Ones, stand fast, right-about—Turn. On the word *Turn*, all except the Number Ones turn to the right-about.

March. On the word *March*, the Number Fours take four paces to the rear, stepping off with the left feet, the Number Sevens seven paces, and the Number Elevens eleven paces.

Front. On the word *Front*, the numbers Four, Seven, and Eleven turn to the right-about.

Re-form two deep—March. On the word *March*, the Number Elevens step off with the left feet and march to the front. At the fourth pace the Number Sevens step off, and at the seventh pace the Number Fours step off. All halt in their original positions.

The above method of numbering is suitable for junior pupils, but for those who are accustomed to drill, the ordinary way of consecutive numbering from right to left is preferable, when the words of command will be as follows :—

Fall in. *Vide* p. 74.
Two deep.
Number. *Vide* p. 76.
Prepare for physical exercise.
Odd numbers of front rank, stand fast.
Rest of squad,
About—Turn.
Even numbers of front rank, four paces.
Odd numbers of rear rank, seven paces.
Even numbers of rear rank, eleven paces.
Quick—March.
Front.
Dress.

Right or left half turn. Front. If Indian clubs are to be used.

Re-form two deep. As before.

2. *In a Confined Space.*

Open Order. Rear rank steps back two (or three) paces.
March.
Right—Turn.
Odd numbers, one side step to left. (13½ inches.)
Even numbers, one side step to right.
March.
Re-form ranks.
March.
Front.
Close order. Rear rank steps forward two (or three) paces.
Cover.

DIRECT LUNG EXERCISES OR BREATHING EXERCISES.

(Recommended by Dr Osler, of Boston, U.S.A.)

Breathing must be done through the nose. The breath must not be held between inspiration and expiration. Each exercise should be repeated about sixteen times.

Fall in, size in single rank, or two deep. *Vide* p. 77.

Vide p. 76.

Open order—March. *Vide* p. 96.

Prove distances. *Vide* pp. 93 and 94.

CAUTION.—*For Breathing Exercises.*

Ready. The pupil will place each hand on its respective hip, fingers to the front, thumbs to the rear.

Exercise 1.

One. On the word *One*, the pupil will take a slow and deep inspiration, filling up the chest from above downwards.

Two. On the word *Two*, the pupil will expire slowly and deeply.

Exercise 2.

One. Inspiration long and quick.

Two. Expiration long and quick.

Exercise 3.

One. Inspiration long and slow.

Two. Expiration long and quick.

Exercise 4.

One. Inspiration long and quick.

Two. Expiration long and slow.

Exercise 5.

One. Inspiration short.

Two. Expiration long.

Exercise 6.

One. Inspiration long.
Two. Expiration short.

Exercise 7.

One. Inspiration short.
Two. Expiration short.

Exercise 8.

One. Inspiration in three jerks or stages.
Two. Expiration long.

Exercise 9.

One. Inspiration long.
Two. Expiration in jerks or stages.

Exercise 10.

One. Inspiration in jerks or stages.
Two. Expiration in jerks or stages.
Attention. *Vide* p. 75. The pupil comes to the position of attention.

CAUTION.—*For Assisted Breathing Exercises.*

Exercise 1.

One. The pupil closes the hands and raises both arms in extension in front until the closed hands are vertically above the head, making a deep inspiration during the movement.
Two. The pupil lowers the extended arms laterally to the sides, meanwhile expiring.

Exercise 2.

One. The pupil raises the arms as before with inspiration.

Two. The pupil depresses the arms downwards and backwards (completing circumduction) with expiration.

Exercise 3.

One. On the word *One*, the pupil during a slow deep inspiration straightens the body to its utmost, and finally rises on tiptoes.

Two. On the word *Two*, the pupil comes to attention with expiration.

Exercise 4.

(*On a strip of carpet.*)

Ready. The pupil lies on the back with the feet to the front.

One. On the word *One*, the pupil raises the extended arms, with closed fists vertically in front, until the hands touch the floor in a line with the head, meanwhile inspiring deeply.

Two. The pupil expires deeply when returning the arms in a vertical plane to the sides.

N.B.—In the second group of exercises, the ratio between inspiration and expiration should be preserved—viz., Inspiration 5, expiration 4, pause 1.

Re-form into single line—March. Rear rank takes side step and two paces to front.

COMBINED MARCHING DRILL.

(*In close order.*)

Each of these exercises should be continued for 32 beats of music, and then followed by the next in order. The time should be marked by each pupil making a beat with the left foot the first time it meets the ground—*i.e.*, 1, 2, 3, 4; 1, 2, 3, 4; 1, 2, 3, 4, &c. These marches are generally done at the opening of each class, after the marching exercise. Subsequently the class forms into line with eyes front, comes to attention, stands at ease, and stands easy. (For Music, *vide* p. 202.)

Fall in, size in single rank— As on p. 77.

or, Form company. As on p. 76.

MILITARY MARCH.

Attention. As on p. 75.

Right—Turn. Quick—March. As on p. 80. On the word *March*, the file steps off with the left foot, and makes a circle of the schoolroom or hall, turning to the left.

Or if in two deep, Ranks right and left—Turn. Quick—March. The pupil on the left of the rear rank makes a turn (to the right) and follows the last pupil of the front rank. Each rear rank pupil on coming to the left end of the rear rank does this in succession, thus forming the whole into a single file.

Marching on Toes.

Change—March. Beat the time with the left foot.

On the toes—Rise. With the legs quite straight, chest well advanced, rise on the toes as high as possible,

and at the same time place the hands on the hips, fingers to the front, thumbs to the rear. The cadence remains the same as in *Quick March*, but the length of pace in marching is reduced to 18 inches.

Hopping March.

Change—March. Left and right—Hop.

Beat the time with the left foot, dropping hands smartly to side.

Place the hands on the hips smartly, and hop forward on the toes of the left foot as high as possible a pace of about 18 inches, head erect, chest thrown well to the front, elbows and shoulders forced backwards and downwards: the right leg perfectly straight and kept well to the rear, toes pointed (*vide* fig. 15).

Fig. 15.

On coming to the ground, make a pace of at least 30 inches with right foot, then

Make hop with right foot as before.

Instead of keeping the hands on the hips, the arms from the position of attention may

be extended upwards in front half-way between the level of the shoulders and the vertical line of the body at each hop.

Gymnastic March, or Knees up.

Change—March.

Resume the quick march, dropping the hands to the side.

For Gymnastic March, open out.

Rear files will step short until full intervals are obtained.

In slow time—March.

Bend the knee and raise it as high as the waist, with the toe pointed downwards, and at the same time place the hands on the hips, and without any pause extend the leg and plant the flat of the foot on the ground, the weight of the body being thrown well forward, and the knee well braced back. Immediately the rear foot leaves the ground, the toe must be pointed downwards; and the body kept perfectly upright throughout the exercise.

Fig. 16.

Hop-and-Kick March.

Change—March. Beat the time with the left foot.

In quick time—Hop and Kick. Hop on the left foot and at the same time kick and extend the right leg upwards and outwards as high as possible. Repeat this by hopping on the right foot and kicking the left leg (*vide* fig. 17).

Fig. 17.

N.B.—Unless the legs are kicked well to the side, the balance is apt to be lost.

Polka-Step March.

(*Very suitable and elegant for Girls.*)

Change—March. Beat the time with the left foot.

Polka step. Dance a double slide forward with the left foot and then with the right—*i.e.*, slide forward on the toes of the left foot 18 inches, then bring the right foot up, so that the ball of the left heel rests on the inner side of the instep of the right foot, and repeat this.

Double-Hop March.

(*Very suitable for Boys and Men.*)

Change—March. Beat the time with the left foot.

Double Hop. Take two hops on the left foot and then a step with the right, two hops on the right and a step with the left.

N.B.—This may be done with the arms extended horizontally to the sides.

Double March.

Change—March. Beat time with the left foot. Drop hands.

Break into double time—Double. The pupils will step off together, at a run, with the left foot. At the same time they will raise their hands as high as the waist, carrying back the elbows and clenching the fists, the flat part of the wrist inwards, arm to the side; the head to be kept erect, and the shoulders square to the front, but moving with the action of the legs. The heels must never touch the ground.

Double Gymnastic March.

Knees up. As in Gymnastic March, but at double time.

Squatting or Frog March.

(*For Advanced Pupils.*)

Beat time with the left foot.

Change—March. Break into slow time. Squatting March.

Extend the arms horizontally in front or to the sides in line with the shoulders, or place the hands on the hips. Bend (or flex) the thighs until they are at right angles to the legs (taking care not to sit on the heels), knees turned outwards; rise on the toes, and hop forward with both feet at once (*vide* fig. 18).

Fig. 18.

FIGURE OR MAZE MARCHING.

(For Music, *vide* p. 218.)

The class is arranged in single rank and formed into file by being turned to the right (or left). The pupils march either at quick time with hands down, or at the double with hands on hips.

The simplest form of figure marching is in reversing *parallel lines*. The class marches a given number of paces in one direction—*e.g.*, to the front or flank—and as each pupil arrives at the point then occupied by the leader, turns about to the right

(or left), and at an interval counter-marches for an equal number of paces in a line parallel to but opposite in direction to the first line ; then turning to the left, a third line is formed, and again to the right a fourth parallel line, and so on repeating the movement as often as may be desired (*vide* fig. 19).

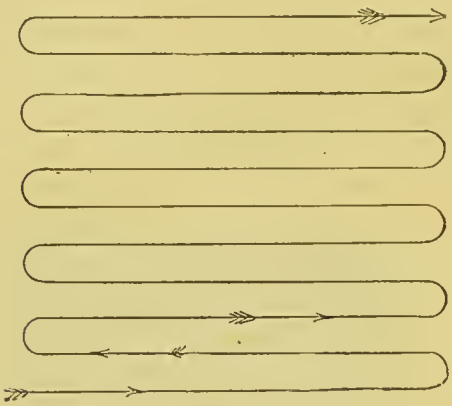


Fig. 19.

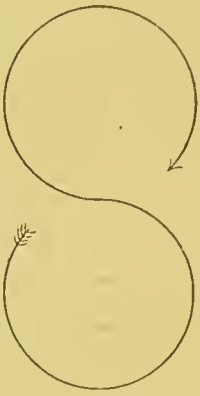


Fig. 20.

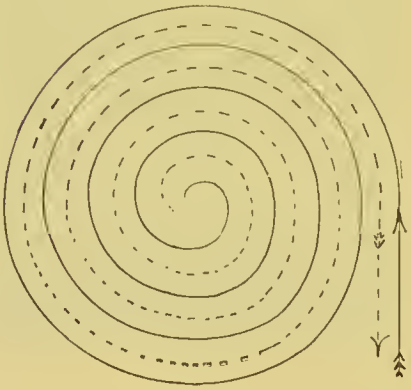


Fig. 21.

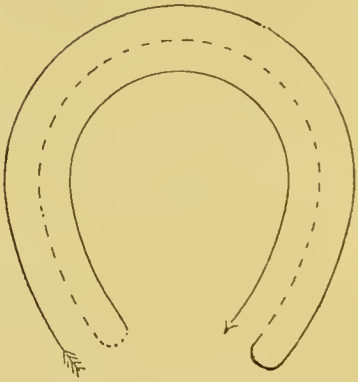


Fig. 22.

Another simple form is the *Figure of 8* movement (*vide* fig. 20). The pupils in file form one circle, and then alternately crossing each other at the centre, complete the other circle of the figure.

A pretty maze is effected by the class in file forming con-

centric *circles* converging on a point and then being evoluted outwards in reversed circles (*vide* fig. 21). The pupils march to the left (or right) so as to form a large circle, within which, when the leading pupil has completed it, they form another and smaller ring, and then another smaller ring, and so on until the centre is reached. On arriving at the centre each pupil turns in the opposite direction—*i.e.*, the right (or left)—and marches outwards in circles between the ingoing circles until the pupil arrives at the point of entrance, when the pupils march in a straight line out of the maze.

If the class is large, a second circle may be formed in line with the first, but in a reverse direction—*i.e.*, turning to the right instead of the left, or *vice versa*, at the beginning of the circle. These circles can, if the number of pupils is sufficient, be repeated alternately in reverse directions either in a straight line or to form two sides of a square, the top and bottom of the square being made by a line of straight marching. A square of circles can also be formed if the class is originally arranged two deep, turned into file on the right, and the front file marched to form a circle entering by the left, and the rear file a circle entering by the right; the second circles being the reverse of these.

Counter-marches so as to form a *horse-shoe* are made by the pupils marching three-quarters of a large circle, turning by the right (or left); then when the three-quarter circle is completed, turning about and forming an inner circle by the left (or right); and again turning about and forming a still smaller inner circle by the right, and emerging at the end opposite to that at which the entrance into the figure was effected (*vide* fig. 22).

Rectangular Figures and *Crosses* may also be easily devised.

A number of original figures are shown in figs. 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33. The direction of the arrow-head indicates the direction which the leading pupil of the file takes in traversing the lines.

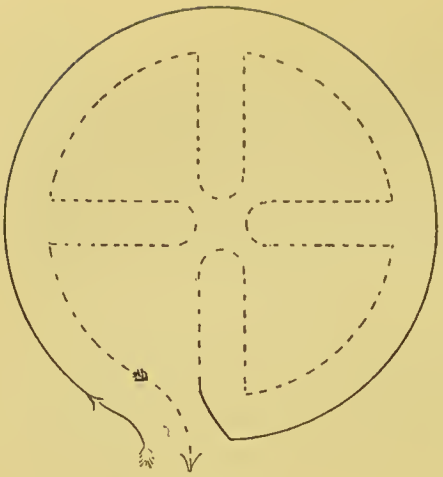


Fig. 23.

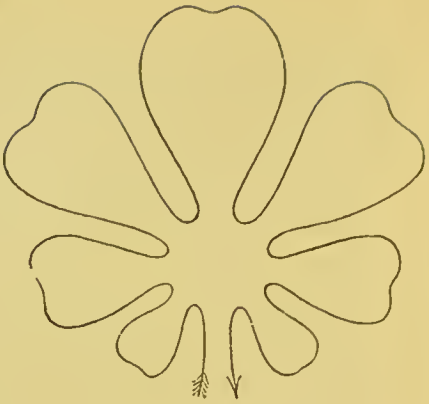


Fig. 24.

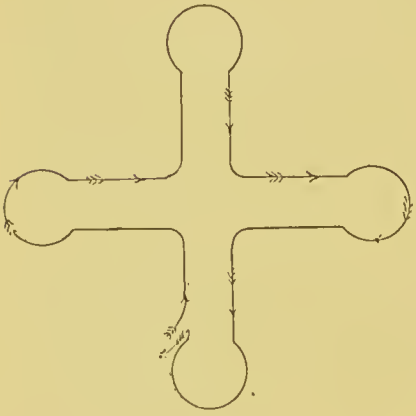


Fig. 25.

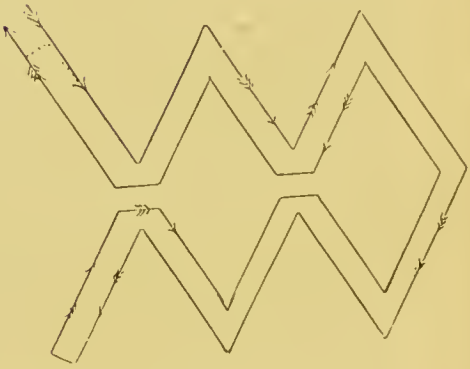


Fig. 26.

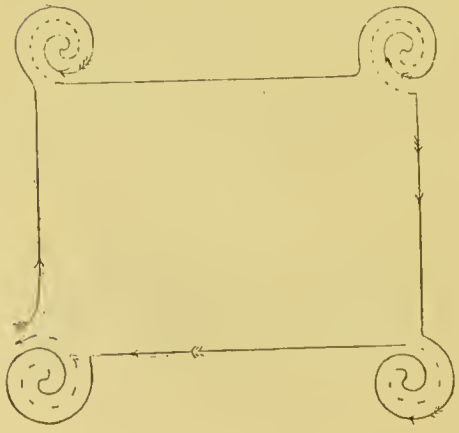


Fig. 27.

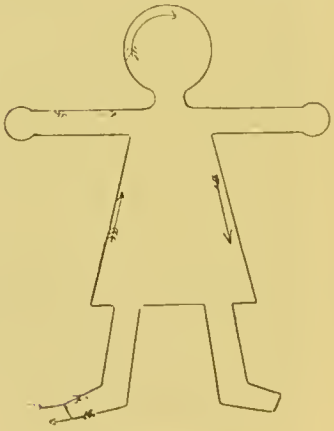


Fig. 28.

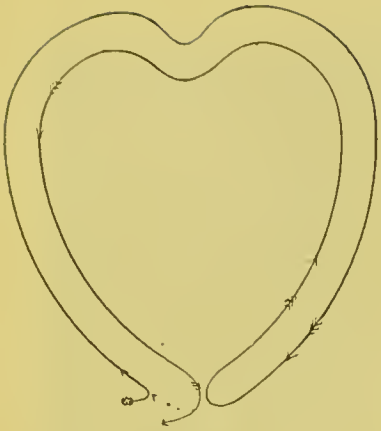


Fig. 29.

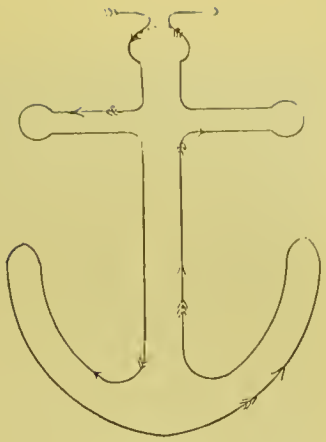


Fig. 30.

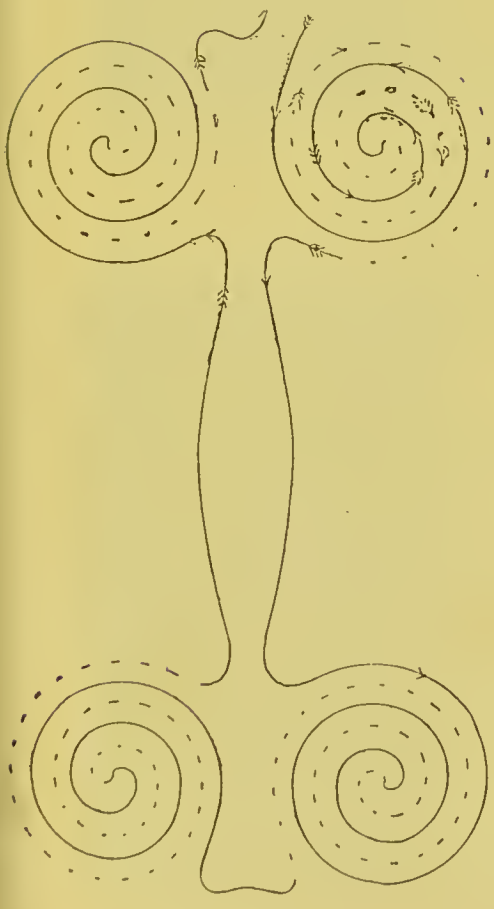


Fig. 31.

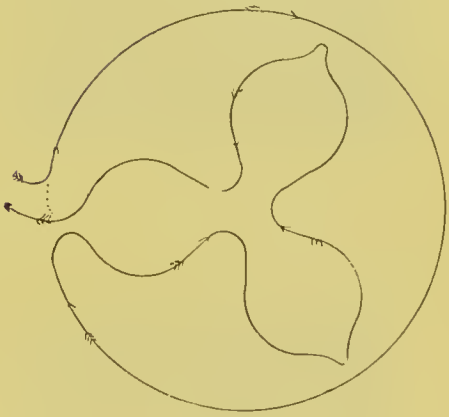


Fig. 32.

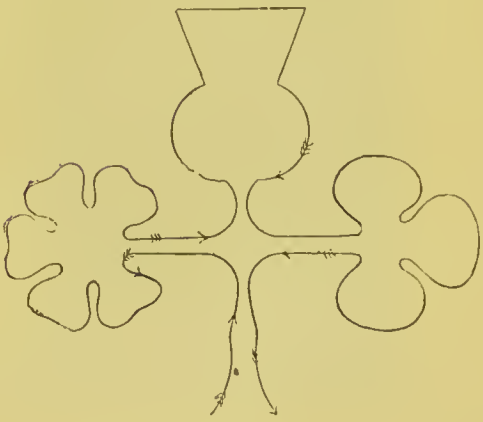
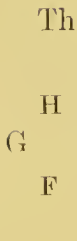


Fig. 33.

FREE MOVEMENTS, OR EXERCISES WITH LIGHT DUMB-BELLS.

(For Music, *vide* p. 222.)



These may be done by individuals at home or in a class. In the latter case the pupils must be arranged in fully extended order in single rank or two deep (*vide* pp. 76, 77, and 94).

Each exercise should be repeated to 32 beats of music.

Exercise 1.

1. From attention bend the arms at the elbows at right angles in front, with the hands clenched, knuckles downwards, and at same time step with right foot to B (*vide* fig. 34).
2. Lunge with right foot to B, circling the hands towards the shoulders, elbows well up (*vide* fig. 35).
3. Draw right foot back well behind left foot, and sweep both arms in extension downwards and forwards, upwards and backwards, behind the body (*vide* fig. 36).
4. About turn to F, with both hands brought to sides, as in position 1 (*vide* fig. 34).
5. Lunge with right foot diagonally, as in movement 2, to G, circling the hands (*vide* fig. 35).
6. Draw back right foot, with both arms circling in extension to behind body, as in movement 3 (*vide* fig. 36).
7. Turn smartly right-about to B, with both arms extended above head (*vide* fig. 37).
8. Come to attention, dropping extended arms sideways.

Repeat 1 to 8 with left foot pointing to H in similar manner.

Exercise 2.

1. Step with right foot sideways to C, raising both arms straight above the head (*vide* fig. 37), but with fingers crossing.

FIG. 34.

FIG. 35.

FIG. 36.

FIG. 37.

2. Bend slowly forward at the hip-joints, with legs straight, and arms and body in one line, until latter are at right angles to the legs, eyes looking to the front (*vide* fig. 38).
3. Rise to position 1.
4. Come to attention.
5. Step backwards with right foot to rear at E, extending the arms straight out sideways at the line of the shoulders, palms upwards and head erect (*vide* fig. 39).
6. About turn on toes, dropping the arms to the side and again extending them sideways with a circular motion.
7. Left-about turn to position 5.
8. Attention.

Repeat these exercises in a similar way, stepping with the left foot to G.

Exercise 3.

1. From attention bend forward and touch the floor with the fingers, drawing the toe of the right foot 2 inches to the rear and outer side of the heel of the left foot, both knees slightly bent (*vide* fig. 40).
2. About turn on toes to F, throwing arms well up above head, keeping a hollow back, and looking diagonally to F with the head well up (*vide* fig. 41).
3. Bring the feet together and squat in a sitting posture, meanwhile circling both arms downwards and backwards, upwards and forwards, in extension in line, with the shoulders in front (*vide* fig. 42).
4. Rise to attention, backs to the front.

After a slight pause, repeat 1 to 4 with the same foot, then drawing left foot behind the right as in position 1, repeat movements 1 to 8 in a similar manner.

Exercise 4.

1. Circle both hands upwards and inwards to the front of the chest, and lunge with the right foot to B, extending the

FIG. 38.

FIG. 39.

FIG. 40.

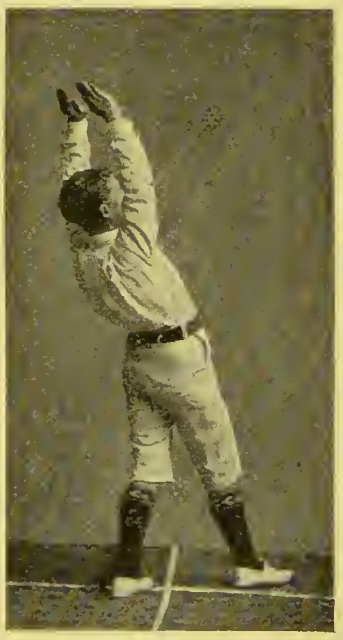


FIG. 41.

arms diagonally so that the right points upwards and the left downwards (*vide* fig. 43).

2. Circle both arms downwards and inwards to the chest, bringing back the right foot.
3. Repeat movement 1, lunging the right foot to D.
4. Recover as in movement 2.

Then repeat as above, with left foot lunging to H and F, and come to attention.

Exercise 5.

1. Right turn to C on heel of right and toe of left foot, with both hands clenched at sides, arms bent.
2. Bring up left foot to heel of right, throwing both arms out straight sideways in line with shoulders.
3. Step out to D with right foot, bringing both hands to shoulders with elbows well up in front (*vide* fig. 44).
4. Lunge with right foot, throwing both arms to D and obliquely upwards, holding head well up (*vide* fig. 45).
5. Draw back right foot, with both hands on shoulders as in Exercise 3.
6. Heels together, with both arms extended straight sideways from the shoulders as in Exercise 2.
7. Turn front on heel of left and toe of right foot, with hands clenched at side as in 2.
8. Come to attention.

Repeat 1 to 8 on opposite side.

Exercise 6.

1. Lunge forward with right foot, throwing out both arms obliquely upwards to front.
2. Circle arms downwards and forward, bring both hands well back.
3. Rise up to first position.
4. Left-about turn on toes.

FIG. 42.

FIG. 43.

FIG. 44.

FIG. 45.

5. Bend well down again, as in Exercise 2.
6. Rise up as in first.
7. Turn right about to front.
8. Come to attention.

Repeat 1 to 8 on opposite side.

Exercise 7.

1. With hands clenched behind back, arms bent, step with knee bent to *b* with right foot, head well up, chest out (*vide* fig. 46).
2. Lunge well forward to B, right arm out in front, left well out behind, forming an oblique line (*vide* fig. 43).
3. Twisting round the body to left, and looking up at left hand, bend down and touch floor with right hand close to heel of left foot, keeping right leg straight and left knee slightly bent (*vide* fig. 47).
4. Completely turn left about on both toes, and bring both hands clenched behind back facing F (*vide* fig. 46).
5. Throw left arm in front and right behind as before (*vide* fig. 43).
6. Bend down and touch floor with left hand, looking up at right (*vide* fig. 47).
7. Turn to right front again, with hands slightly crossed immediately above head. Arms extended upwards.
8. Come to attention.

Repeat 1 to 8.

MOVEMENTS WITH CUPS OR HAND-BELLS.

(For Music, *vide* p. 224.)

To ensure accuracy of movement, the writer has found it advantageous to substitute for light dumb-bells some fragile article, such as an ordinary china cup. The pupil is thus

FIG. 46.

FIG. 47.

FIG. 48.

FIG. 49.

compelled to take special care to avoid breaking the article, and accordingly gives more attention to position. This, of course, would only be possible for home gymnastics. The author has also had the same movements effectively performed with small hand-bells or little Swiss cow-bells when music was not available. The latter method is very pretty and effective in a schoolroom or gymnasium.

A
H B
G O C
F D
E

Each exercise should be repeated to 32 beats of music.

Exercise 1.

1. Swing bells to strike straight in front at line of shoulders, at same time stepping with right foot to rear E (*vide* fig. 48).
2. Swing bells to meet behind back, stepping forward with right foot to A.
3. Step with right foot to C, swinging hands to meet straight above head (*vide* fig. 49).
4. Attention.

5-8. Repeat opposite side.

Exercise 2.

1. Extend arms horizontally sideways, throwing right foot over front of left to H (*vide* fig. 50).
2. Left-about turn on toes, swinging arms past sides and back to horizontal (*vide* fig. 51).
3. Step forward to E with right foot, swinging arms to front, horizontal, knuckles down (*vide* fig. 52), but facing rear E.
4. Bring up hands inwards and downwards to the chest, and come to attention circling hands (*vide* fig. 53).

5-8. Repeat 1 to 4 to right.

9-16. Repeat 1 to 8 on opposite side with left foot over right.

FIG. 50.

FIG. 51.

FIG. 52.

FIG. 53.

Exercise 3.

1. Step right foot to A, right arm extended to front, left hand drawn up to chest (*vide* fig. 54).
2. Withdraw right foot to rear E, reversing position of arms.
3. Bring forward right foot to A, and right hand to meet left in front in line of shoulders (*vide* fig. 52).
4. Circle bells inwards and downwards towards chest (*vide* fig. 53), and bring down to attention.

5-8. Repeat opposite side.

Exercise 4.

1. Pass right foot over left to G, right hand in left armpit, elbows well up, left arm extended vertically, head erect (*vide* fig. 55).
2. Step with right foot to C, reversing position of arms as in previous fig.
3. Lunge to rear F, extending arms horizontally outwards, head well up, left knee slightly bent, right leg straight (*vide* fig. 56).
4. Come to attention.

5-8. Repeat on opposite side.

N.B.—Wrist twist the bells at each change of position—*i.e.*, circle the hands at the wrists.

Exercise 5.

1. Step right to C, left knee straight, right hand on shoulder, head facing G, right elbow out and up, left extended horizontally to G (*vide* fig. 57).
2. Come to attention.
3. Repeat 1 on opposite side.
4. Attention.

5-8, &c. Repeat 1 to 4.

FIG. 54.

FIG. 55.

FIG. 56.

FIG. 57.

Exercise 6.

1. From attention squat, arms straight in front (*vide* fig. 42).
2. Throw arms downwards, and immediately circle them backwards past sides to rear, and round to attention.
3. Squat down, arms extended upwards.
4. Bring arms downwards, outwards, and inwards, completing a circle across breast to attention.
5. Turn right to C, bending to touch ground with finger-tips, at same time extending left leg off ground nearly horizontally (*vide* fig. 58).

Fig. 58.

6. Return to attention.

7-8. Repeat 5 and 6 to opposite side.

Exercise 7.

1. Lunge sideways to right C, same time extending arms in oblique line C G, as in fig. 59.
2. About turn on left heel, reversing position of arms.
3. Return to position 1.
4. Bring fingers in to chest (*vide* fig. 53), turning them down to attention.

5-8. Repeat on opposite side.

Exercise 8.

1. Step forward with right foot to A, and touch ground with fingers or bells at sides of right foot, arms straight, bending well forward, eyes up (*vide* fig. 60).
2. Put right hand on right knee and face towards G, raising left arm up to perpendicular (*vide* fig. 61).
3. Circle left arm downwards and outwards to right across body, at same time turning left to E, and finish with hands clasped at back of shoulders, elbows well up, legs straight, and head back (*vide* fig. 62).
4. Bring up right foot and come to attention, facing E.

5-8. Repeat 1 to 4 to finish facing A.

9-16. Repeat 1 to 8 on opposite side.

Exercise 9 (*a*).

1. Lunge forward with right foot, arms extended in front, palms down, head well up.
2. Bend forward, throwing arms to rear.
3. Up smartly to 1.
4. Step back to attention.

Exercise 9 (*b*).

1. Step well back to E with right foot, arms extended in front.
2. Step with right foot from E to A, throwing arms smartly to rear (or touching fingers under right knee).
3. Return to 1.
4. Repeat with left.

Step forward to attention.

Repeat Exercise 9, *a* and *b*, on opposite sides.

TRUNK MOVEMENTS.

N.B.—Some of these exercises should be done on a strip of carpet.

Fall in, size in single rank, tallest on the right, shortest on the left. *Vide* p. 77.

Extend by threes. *Vide* p. 94.

Exercise 1.

From position of attention.

1. Arms straight above head, step with right foot to C, chest well out.
2. Bend body sideways to the right, looking well up.
3. Return to first position.
4. Bend body to left side as in position 2.
5. Return to first position.
6. Bend forward from the hips, keeping the arms straight out in front, head between arms as in fig. 37, but with feet together.
7. Return to first position.
8. Bend body backwards, arms straight up.
9. Return to first position.
10. Come to attention.

Exercise 2.

From position of attention.

1. Step to rear E with right foot, arms extended horizontally sideways in front (*vide* fig. 56), but with right foot at E.
2. Bend body round sideways and downwards until the right hand touches the floor, with right knee bent, keeping left

FIG. 59.

FIG. 60.

FIG. 61.

FIG. 62.

leg in front as straight as possible, with left arm vertical (*vide* fig. 47).

3. Return to position 1 (*vide* fig. 56).
4. Bend body round sideways to left till left hand touches floor.
5. Recover to 1.

Repeat 1 to 5 with left foot to rear E.

Exercise 3.

1. Step to the rear E as in last exercises with right foot.
2. Touch floor with right knee, hands at side.
3. Bend forward until forehead meets left knee (*vide* fig. 63).

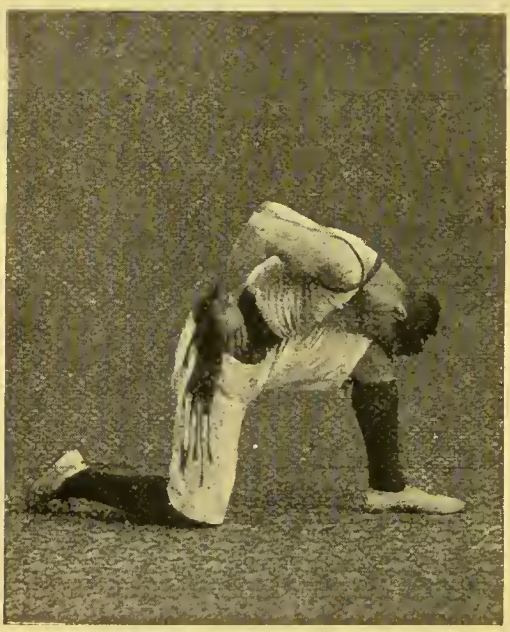


Fig. 63.

Fig. 64.

4. Recover to 1.
5. Bend body well back, with hands at side as in Exercise 2, but looking well up.
6. Recover to 1.
7. Rise up smartly.

8. Attention.

Repeat 1 to 8, kneeling on left knee. Repeat above movements, straightening the advaneed leg and holding arms outwards and upwards straight, or at sides as in fig. 64.

Exercise 4.

1. Step forward A, with right foot, toueh floor with both hands.
2. Draw baek right foot to D (*vide* fig. 65).

Fig. 65.

3. Draw back left foot to E (*vide* fig. 66).

Fig. 66.

4. Hold up left arm straight (*vide* fig. 67).
5. Turn body to rear on right arm till left hand touehes floor,

back as hollow as possible, legs and arms straight, body resting on hands and heels (*vide* fig. 68).

6. Recover to previous position, holding up left arm as in fig. 67.

Fig. 67.

Fig. 68.

7. Bring feet together between hands.
8. Spring up smartly to attention.

Repeat 1 to 8 with left hand.

Exercise 5.

1. Hands at sides, four fingers to front.
2. Bend down until both knees touch floor (*vide* fig. 69).
3. Bend body forward till forehead touches the floor (*vide* fig. 70).
4. Recover to 1.
5. Bend sideways to right until elbow touches floor, turning head to left and looking up (*vide* fig. 71).
6. Recover slowly to first position.

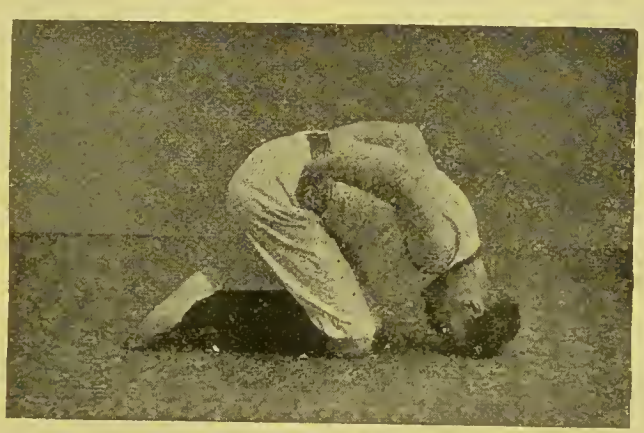


Fig. 70.

7. Bend sideways left until elbow touches floor.
8. Recover to 1.
9. Bend backwards until both elbows touch the floor (*vide* fig. 72).
10. Bend backwards until head touches floor.
11. Raise up head off floor.
12. Raise up elbows.
13. Rise slowly and come up to attention, without moving the feet forward or backward.

FIG. 69.

FIG. 71.

FIG. 72.

FIG. 73.

Exercise 6.

1. Squat down, throwing arms up sideways.
2. Bring arms down behind thighs until hands touch floor. Be careful not to fall backwards (*vide* fig. 73).
3. Spring forward with legs, resting body on arms (*vide* fig. 68).
4. Sit on floor with arms folded.

Exercise 7.

1. From sitting position, Exercise 6, put arms out straight in front.

Fig. 74.

2. Bend body backwards slowly from the sitting position, taking great care not to knock the head too hard on the floor.
3. Raise body slowly up to first position.
4. Fold arms.

This exercise done with hands at back of head, as in fig. 74, is somewhat difficult, but with a little practice will strengthen the loins.

Exercise 8.

1. From sitting position put arms out horizontally sideways.
2. Bend body forward slowly until forehead almost touches knees, keeping legs as straight as possible (*vide* fig. 75, showing exercise done with arms folded).

Fig. 75.

3. Raise body to sitting position slowly.
4. Arms folded.

Exercise 9.

From sitting position.

1. Hands at sides, elbows outwards.
2. Bend body to right until elbow touches floor.
3. Turn head to left, looking upwards, legs straight.
4. Rise slowly without any jerking of the body.

Repeat 1 to 4 on left side.

Exercise 10.

From sitting position.

1. Bend backwards until elbows touch floor, hollow back.

2. Bend back until head touches floor.
3. Raise head with hands at back of neck (*vide* fig. 74).
4. Return to sitting position slowly.

Exercise 11.

From sitting position with arms folded across chest, head well up.

1. Raise right foot 2 inches from the floor (*vide* fig. 76).

Fig. 76.

2. Carry right foot along to right side 2 feet, and return again slowly, keeping the back straight.
3. Rest.

Repeat 1 to 3 with left foot and legs straight.

Exercise 12.

From attention.

1. Hands at sides, elbows out sideways.
2. Bend forward slowly till knees touch floor.
3. Placing feet and legs apart, sit on floor.
4. Bend back as in Exercise 5, until elbows touch floor (*vide* fig. 72).

5. Bend back until head touches floor.
6. Raise head.
7. Raise body.
8. Raise body from the knees to attention.

Exercise 13.

Hands at side, elbows out sideways.

1. Turn head round sideways to right.
2. Return slowly to first position.
3. Turn head round to left side, keeping body straight.
4. Return to first position.
5. Bend head backwards.
6. Return to first position.
7. Bend forward.
8. Return to first position and come to attention.

ROD OR WAND EXERCISES.

(For Music, *vide* p. 226.)

For Infants.

These movements have an educational value similar to that of Bar-bell Drill, but may be engaged in by the youngest pupils.

ARRANGEMENT OF CLASS.

Fall in, size in single rank or Two deep. *Vide* pp. 76 and 77. The pupils carry the wands in their right hands at the position of "Shoulder arms."

Extend to full intervals—March. *Vide* p. 94.

Ready or Attention. Grasp the wand, knuckles to the front, thumbs to the rear, at the commencement of the outer quarters of the wand.

Each exercise should be repeated to 32 beats of music.

A
H B
G O C
F D
E

Exercise 1.

1. Raise rod horizontally across chest.
2. Lower rod to attention.

Repeat to 32 beats of music.

Exercise 2.

1. Raise rod with left hand to right side of chest, elbow well up in front, right arm fully extended downwards to right side (*vide* fig. 77).
2. Come to attention.
3. Raise rod with right hand to left side of chest, elbow well up, left arm fully extended downwards to left side.
4. Attention.

Repeat to 32 beats of music.

Fig. 77.

Exercise 3.

1. Elevate extended arms horizontally above head.
2. Lower rod horizontally to front of chest.
3. Elevate extended arms horizontally above head.
4. With extended arms come to attention.

Repeat to 32 beats of music.

Exercise 4.

1. Elevate extended arms horizontally above head, at same time rising on tiptoe.
2. Lower rod horizontally to front of chest, bringing heels down.
3. Elevate extended arms horizontally above head, rising on tiptoe.
4. Come to attention with heels down.

Repeat to 32 beats of music.

Exercise 5.

1. Step with right foot to A, extending arms horizontally in front.
2. Bring right foot back to attention, raising rod horizontally above head with extended arms.
3. Repeat No. 1.
4. Come to attention.

Repeat stepping forward with left foot. Then repeat whole over again to 32 beats of music.

FIG. 78.

Exercise 6.

1. Sweep rod over right shoulder to back of body, pointing rod with extended right hand to C (*vide* fig. 78).
2. Reverse rod behind back, pointing with extended left hand to G.
3. Bring rod to horizontal line behind neck.

4. Come to attention, carrying the rod with extended arms over head to front.

Repeat, sweeping rod on left shoulder. Repeat whole exercise to 32 beats of music.

Exercise 7.

1. Extend rod horizontally in front of chest.
2. Bring rod horizontally to breast.
3. Extend rod horizontally in front of chest.
4. Come to attention.

Repeat to 32 beats of music.

Exercise 8.

1. Bending body and legs into half-squatting position on toes, extend rod horizontally in front of chest.
2. On tiptoe elevate rod horizontally above head.
3. Squat down fully (*vide* Squatting March), bringing bar horizontally to front of chest.
4. Rise, sweeping rod to attention.

Repeat to 32 beats of music.

Exercise 9.

1. Lunge with right foot to C, right knee bent, extending right end of rod horizontally in line of shoulder in direction of C (*vide* fig. 79).
2. Attention.
3. Lunge with right foot to A, extending right end of rod horizontally in front.
4. Attention.

Repeat lunging with left foot to G and A, extending rod horizontally in that direction. Repeat whole exercise to 32 beats of music.

Exercise 10.

1. Step with right foot to A, extending rod horizontally in front to A (*vide* fig. 80).
2. Bring right foot forward to attention, elevating with extended arms rod horizontally above head.

Fig. 79.

Fig. 80.

3. Step with left foot to A, extending rod horizontally in front to A.
4. Bring left foot forward, and sweeping rod downwards in front, come to attention.

Repeat with left foot, stepping to E. Repeat whole exercise to 32 beats of music.

Exercise 11.

1. Elevate rod horizontally with extended arms above head.
2. Step with left leg to G, bending body to right side; sweep

right hand downwards in front of body to left side as far as possible, extending left hand also to left (*vide* fig. 81).

3. Return to No. 1.
4. Attention.

Repeat, bending body to left side with rod to right. Then repeat whole exercise to 32 beats of music.

Fig. 81.

Exercise 12.

1. Bring left hand to right shoulder and extend right arm sideways to C at level of shoulder, meanwhile lunging with right foot to C.
2. Bringing feet to attention, extend the left hand to the left, sweeping the right arm over the head to back of neck.
3. Sweep right arm over head to front, and extend right arm as in No. 1.
4. Come to attention.

Repeat, extending left arm. Then repeat whole exercise to 32 beats of music.

Exercise 13.

1. With arms extended raise rod over head and bring it down with extended arms to the back of the body. (This is popularly misealled a dislocation movement.) (*Vide* fig. 82.)
2. Return in reverse direction to attention.
3. Repeat No. 1, but with right foot stepping to A.
4. Return to attention.

5. Repeat No. 1.
6. Repeat No. 2.
7. Repeat No. 1, but with left foot stepping to A.
8. Attention.

Repeat whole exercise to 32 beats of music.

Fig. 82.

EXERCISES WITH BAR-BELL OR ROD.

(For Music, *vide* p. 228.)

For Single Pupils.

With Index Bar-Bell.

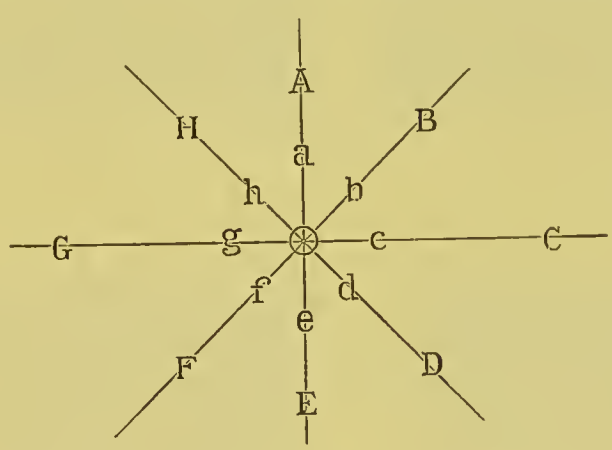
Bar-bell exercises being essentially a combination of the free movements of the limbs and trunk, develop the muscles generally, improve the carriage, and are especially good for securing co-ordination, grace, and precision of movement. They also cultivate the memory of motor acts.

The index bar-bells[1] carries a movable ball which slides between two knobs eighteen inches apart. In any exercise in which the bell takes an oblique position the ball will click sharply against the lower knob, so that both teacher and pupils know at once whether the exercise has been performed in good time or otherwise. If the bell be moved vigorously in a horizontal direction, the same result will be obtained. This apparatus also carries two bells in the position of the terminal knobs, thus securing a pleasant jingle throughout the exercise, and particularly at turning movements. The

[1] Designed by Mr Sturrock, and made at The Fechney Industrial School, Perth.

bar-bell is 3 feet in length. In dislocation movements it is to be grasped close to the outer knobs, and the bell must be kept perfectly level when movements of this nature are being performed. In breast-twists—that is, in movements where the arms are crossed over the chest—the bar-bell must be grasped close to the inner knobs: the distance between the knobs has been fixed so as to secure the proper squaring of the shoulders required for these movements. With the ordinary bar-bell many of these exercises are marred by the pupil unconsciously adopting a wrong distance.

There are two ways of holding a bar-bell. In what is known



as the "ordinary grasp," the bar is held at the commencement of the outer quarters of the bar with the backs of the hands to the front and the thumbs to the rear. In the "reverse grasp" the palms of the hands are upwards, the fingers to the front, and the thumbs over the bar. Until the exercises are commenced the bar is held in the right hand in the position of "Shoulder arms."

A "step" is a pace, half the length of a "lunge," in a given direction. In the latter movement the lunging knee is bent and the other knee held straight, whereas in stepping, as a rule, the knee opposite to the arm thrown into extension is slightly

flexed—*e.g.*, the right knee when the left arm is extended. The eyes generally follow the direction of the bar-bell.

The positions assumed in these exercises may be easily learned at first by chalking on the floor a combined St George's and St Andrew's cross, and lettering the lines as shown in the diagram on p. 141.

Arrangement of Class.

In arranging a class for bar-bell drill, extension may be carried out by any of the methods given under Extension Drills (*vide p.* 94), or by the Opening-out March given under Indian Club exercises (*vide p.* 94).

Each exercise should be repeated to 32 beats of music.

Exercise 1.

Position.—Attention with reverse grasp (*vide* fig. 83).

1. Step with right foot to *b*, raising right hand to breast, twisting it outwards, so as to bring palm to front, elbow well raised off chest, at same time extending left hand in direction of H, pointing bar-bell diagonally upwards (*vide* fig. 84).
2. Lunge with right foot to C, bending knee, at same time extending right arm diagonally upwards to C, meanwhile twisting the hand to the front, so that back of hand becomes upwards, and carrying left hand to back of head, elbow well raised (*vide* fig. 85).
3. Return to end of position 1.
4. Attention with reverse grasp.

Repeat this movement eight times. Then repeat it to the left side. Then repeat it, lunging right foot to B, and repeat it eight times, lunging left foot to G (*vide* fig. 85*a*).

This may be done in the four different directions consecutively to 32 beats of music.

FIG. 83.

FIG. 84.

FIG. 85.

FIG. 85*a*.

Exercise 2.

Position.—Attention with ordinary grasp.

1. Step with right foot to *b*, carrying left hand to armpit of right arm, elbow well up, and, extending right arm, point bell diagonally upwards to B (*vide* fig. 86).
2. Lunge to B, letting go bar-bell with left hand, and with right hand as pivot swing left end of bar upwards to B, and catch hold of other end of bar with left hand resting on right thigh a little above knee-cap (*vide* fig. 87).
3. Free the bar with the left and make a reverse swing to end of position 1.
4. Attention.

Repeat. Repeat, stepping with right foot to *d*. Repeat with right hand in left armpit, stepping to *h*. Repeat, stepping to *f*, to 32 beats of music.

Exercise 3.

Position.—Ordinary grasp.

1. As in No. 1 of Exercise 2.
2. Lunge to B with right foot and throw upper end of bar backwards over right shoulder, pointing with right arm extended diagonally to F, body also being bent backwards to F (*vide* fig. 88).
3. Return to 1.
4. Attention.

Repeat. Then lunge with right foot to D, pointing bar to H, twice. Then lunge with left foot to H, pointing bar to D. Repeat, lunging left foot to F, pointing bar to B.

N.B.—This exercise may be combined with Exercise 2 by following the 1, 2, 3, 4 motions of Exercise 2 with the 1, 2, 3, 4 motions of Exercise 3. Of course this combination requires 64 beats of music.

FIG. 87.

FIG. 88.

FIG. 89.

FIG. 90.

Exercise 4.

Position.—Ordinary grasp.

1. Step with right foot to *h*, throwing bar-bell over right shoulder with right hand pointing downwards diagonally to D, and left hand behind head, left knee slightly bent, eyes looking downwards to D (*vide* fig. 90).
2. Attention.
3. Step with left foot to *b*, throwing bar-bell over left shoulder with left hand pointing diagonally downwards to F, right hand behind head, right knee slightly bent.
4. Attention.
5. About turn (to right) with right foot alone, stepping with right foot to *e*, throwing bar-bell over right shoulder when turning round, and point right hand diagonally downwards to H, left hand at back of head, left knee slightly bent (*vide* fig. 91).

Fig. 91.

6. Attention. About turn (to right) to front, dropping bar-bell to attention.
7. Left-about turn with left foot alone, stepping to *e*, throwing bar-bell over left shoulder when turning round, and point left hand diagonally downwards to B, right hand at back of head.
8. Attention.
9. Repeat movement 1.
10. Step to rear E with right foot, carrying bar-bell behind back to reverse position, so that left hand points diagonally

downwards to F, with right hand at back of head (*vide* fig. 91, but reverse shoulder).

11. Return to movement 1.
12. Attention.
13. Repeat movement 3.
14. Step to rear E with left foot, changing bar-bell to reverse position behind back, so that right hand points diagonally downwards to D, with left hand at back of head.
15. Return to movement 3.
16. Attention.

Repeat whole exercise.

Exercise 5.

Position.—Ordinary grasp.

1. Cross right foot in front of left foot to *h*, carrying bar-bell horizontally above head, transverse to body (*vide* fig. 92).
2. Rise on both toes and turn about to left, bringing heels together and squatting down on toes, holding bar-bell horizontally at full extent of arms to E (bar-bell at right angles to line of E).
3. Rising up, cross right leg as in 1, to *d*, elevating bar horizontally above head.
4. Attention. Left-about turn to front A.

Fig. 92.

Repeat. Then repeat, crossing left foot in front of right foot to *b*, and about turning to the right, crossing left foot to *f*. Repeat to 32 beats of music.

Exercise 6.

Position.—Ordinary grasp.

1. Step back with right foot to *f*, pointing right end of bar-bell upwards, then eireling it downwards to left in front, stop at central line of body on the floor with right arm extended and left hand in right armpit. Right knee slightly bent, left leg straight, eyes looking to front (*vide* fig. 93).

Fig. 93.

2. Cirele bar-bell, left hand passing out of armpit to crown of head and right hand pointing diagonally upwards to F, right arm extended, right leg straight, left knee slightly bent, body bent backwards, eyes towards F, and feet firm on ground (*vide* fig. 94).
3. Keeping feet in position, twist body to *B*, and reversing position of hands, bring right hand to crown of head and extend left hand diagonally upwards to B, eyes looking in same direction (*vide* fig. 95).
4. Lunge with right leg from F to B, carrying bar-bell horizontally over back of head and down behind back, right knee bent, left leg straight.
5. Twist body to F, keeping feet fast, and cirele bar-bell into position of No. 2, pointing with right hand to ground, with left hand in armpit (*vide* fig. 93, but reverse side).
6. Keeping feet in position, raise body in line of F, bringing

right hand to crown of head and pointing with extended left arm diagonally upwards to F, right knee slightly bent, eyes looking up to F.

7. Twist body to B, bringing left hand to crown of head and right arm extended diagonally up to B, left knee slightly bent, eyes looking upwards to B.
8. Attention.

Repeat this exercise with the left foot stepping to *d*.

N.B.—Each movement of the above combination of exercises can be done as a separate exercise to 16 or 32 beats of music.

Exercise 7.

Position.—Ordinary grasp.

1. Step with left foot to *a*, placing left hand on right shoulder, right arm extended, circle up in front to A, pointing diagonally upwards, left leg slightly bent (*vide* fig. 96).
2. Depress right hand to side, and passing it behind back extend both arms above head, bringing back right foot to left. (*N.B.*—The pupils are now a pace to the front.)
3. Lower bar-bell in front of body, throwing left hand in front of right collar-bone and extending right arm with bell pointing diagonally downwards to A, stepping with left foot to *e*, left knee slightly bent, head turned to H (*vide* fig. 97).
4. Bring left foot up to attention in front, crossing bar-bell in front of chest with left hand to right shoulder and right hand to left armpit, right arm undermost.

Repeat, but in finishing cross the bar-bell with the right arm above the left arm. Then repeat the movement in opposite direction, stepping with right foot to *a*, &c. Repeat to 32 beats of music.

FIG. 94.

FIG. 95.

FIG. 96.

FIG. 97.

Exercise 8.

Position.—Ordinary grasp.

1. Squat down on tiptoes, heels together, bar-bell extended horizontally in front (*vide* fig. 98, which shows half-squatting position).
2. In rising up step with right foot to *f*, right hand behind head, left arm extended pointing diagonally upwards to F, eyes looking upwards to F (*vide* fig. 99).
3. Turn on heels to C, bringing right hand to armpit of left, elbow well up off chest, extending left arm vertically upwards (*vide* fig. 100, which shows position of arms).
4. Turn on heels to E, circling right hand to right side and passing it backwards to behind head, extending left arm vertically upwards (*vide* fig. 101).
5. Drop left hand to right collar-bone and extend right arm pointing diagonally downwards to E, left leg slightly bent, eyes looking downwards to E.
6. About turning (to right), raise right arm, circling it to front, and point diagonally downwards to rear, bring left hand to right armpit, right knee slightly bent, eyes looking up.
7. Throw right arm upwards and backwards, pointing diagonally to E, bending body backwards, right leg slightly bent, eyes looking upwards to *e* (*vide* fig. 102).
8. Attention.

Repeat with left leg going back.

N.B.—Separate exercises can be formed of each of the above movements.

Repeat to 32 beats of music.

FIG. 98.

FIG. 99.

FIG. 100.

FIG. 101.

Exercise 9.

Position.—Ordinary grasp.

1. Step with left foot to *a*, bringing right hand behind head, and pointing diagonally upwards to A with extended left arm (*vide* fig. 103, shown pointing to C).
2. Draw right foot up to left and about turning to E, with feet in position of attention, bring bar-bell horizontally down behind back.
3. Raise bar-bell above head, and bringing right hand to left armpit, extend left arm diagonally upwards to E, stepping to *e* with right foot (*vide* fig. 102).
4. Drop to attention, facing rear.
5. Repeat No. 1, stepping to E with left foot.
6. Repeat No. 2.
7. Repeat No. 3.
8. Attention, facing front.

Repeat Exercise, stepping with right foot to *a*, bringing left hand behind head. Repeat to 32 beats of music.

Exercise 10.

Position.—Ordinary grasp.

1. Step with right foot to *c*, bringing right hand to front of left shoulder, elbow well up, left arm extended pointing diagonally upwards to G.
2. Step with right foot behind left from *c* to *g*, bringing left hand to front of right shoulder and extending right arm to C, pointing diagonally upwards (*vide* fig. 104).
3. Twist body by right to F, throwing bar-bell over back of shoulders, pointing diagonally upwards with left hand to D, and downwards with right hand to H, leaning body well back, legs straight.
4. Attention, facing rear.
5. Repeat, stepping with right foot to *g*, pointing bar-bell to C.

FIG. 102.

FIG. 103.

FIG. 104.

FIG. 105.

6. Step with right foot behind left from *g* to *e*, extending right arm to G.
7. Twist body to B, throwing bar-bell over back of shoulders, pointing with left hand diagonally upwards to H, and with right downwards to D.
8. Attention to front.

Repeat exercise, with left foot stepping to *g*. Repeat to 32 beats of music.

Exercise 11.

Position.—Ordinary grasp.

1. Step with left foot to *g*, bringing right hand to left armpit, and extending left arm vertically above head.
2. Twist body to C, legs straight, and extend arms horizontally above head.
3. Stoop forward, touching floor with bar-bell in front of right toes.
4. Bend on left knee, pointing with extended right hand diagonally upwards to D, left hand in front of chest (*vide* fig. 105).
5. Rise and twist body to G, carrying bar-bell horizontally over head to small of back.
6. With reverse motion bring bar-bell over head to front, crossing arms over chest, left above, right below.
7. Extend bar-bell horizontally above head.
8. Attention.

Repeat exercise with right foot, stepping to C. Repeat to 32 beats of music.

Exercise 12.

Position—Ordinary grasp at attention.

1. Place right hand in left armpit and extend left arm vertically upwards (*vide* fig. 100).
2. Disengage right hand, and lowering left hand to left shoulder, bar-bell vertical, pass right hand behind body and re-grasp bar-bell at back.

Fig. 106.

3. With right foot step to *e*, body facing A, and point extended left arm diagonally downwards or upwards to A.
4. About turn (to right), body facing E, reverse bar-bell by pushing it along hollow of back, and extend right arm diagonally downwards or upwards to E, left arm at left side of body, eyes looking to E (*vide* fig. 106).
5. About turn (to left), and point bell to A, as in No. 3.
6. Bring right foot up to left at attention, and extend left arm vertically upwards with right hand behind back, as in No. 2.
7. Disengage right hand and re-grasp bar-bell in front of body, as in No. 1.
8. Attention.

Repeat to left side. Repeat to 32 beats of music.

Exercise 13.

Position—Ordinary grasp at attention.

1. Take bar-bell at the middle with right hand alone, and bending arm, bring bar vertically in line with body, hand close to right side, left arm at attention.
2. Extend vertical bar to front.
3. Return to position 1.
4. Extend vertical bar sideways to right.
5. Return to position 1.
6. Repeat No. 4.
7. Keeping right arm extended, step to *e* with right foot, turning body and right arm in that direction.

8. Sweep extended right arm back to A, returning right foot to attention, as in No. 2.
9. Bending right forearm acutely on upper arm, throw bar-bell horizontally over right shoulder so as to point from front to rear.
10. Extend horizontal bar in same direction above head.
11. With circular sweep over crown of head drop bar-bell into left hand, which is brought to top of left shoulder.
12. Extend bar above head with left hand as in No. 10, meanwhile dropping right arm to attention.
13. Make large step or straddle with right leg to C, legs straight, sweeping left arm sideways to left knee, bar as before, elevating right arm vertically, face turned upwards to right hand, and body well bent to left side.
14. Return to position 12.
15. Twist rear end of bar-bell to right side and grasp bar-bell with both hands, arms extended above head.
16. Come to attention, sweeping bar-bell with extended arms in front of body.

This exercise may be repeated as a whole. 1 to 8 and 9 to 16 may be done as separate exercises, each group being repeated once.

EXERCISES WITH BAR-BELL OR ROD.

(For Music, *vide* p. 230.)

Two Pupils together.

There are a certain number of dull children in every class, and the following method has been designed to lighten the instructor's work, and to save the time often wasted in trying to make such children understand even the simplest movements. If a smart pupil is placed alongside a dull one, the lesson will be learned by the latter in much less time and with much less trouble to the teacher.

ARRANGEMENT OF CLASS.

Fall in. *Vide* p. 74 or p. 76.

Two deep. The pupils in the front rank alone have bar-bells, carrying them in right hands at "Shoulder arms."

Number. *Vide* p. 76.

Method 1.

Right—Turn. Odd numbers two paces to left (front); even numbers two paces to right (rear)—March. *Vide* p. 80.

Method 2.

Open order—March. *Vide* p. 96.

Extend by twos to length of bar-bell, numbers 1 and 2 standing fast—March. Attention. The pupils extend in pairs by side steps, the odd numbers proving distances by extending their bar-bells sideways at the level of the shoulders, so that the near bell touches their own right shoulder and the far bell the left shoulder of the pupil to the right.

POSITION.

Ready. Both pupils stand in first position, facing the front, and take hold of the bar-bell or rod, the right hand of the pupil on the left crossing in front of the left hand of the pupil on the right. The four hands to be at equal distances on the bar-bell.

Each exercise should be repeated to 32 beats of music.

Exercise 1.

1. Throw the bar-bell above the head without bending the arms, both pupils stepping to the front with the right foot.
2. Same as 1, but stepping with the left foot.
3. Same as 1, but stepping to the rear with right foot.
4. Same as 1, but stepping to the rear with left foot.

Exercise 2.

1. Throw bar-bell above the head, keeping chest well forward, with feet at attention (*vide* fig. 107).
2. Pass the bar-bell down over the back, and also step forward with the right foot, keeping the back hollow.
3. Bring the bar-bell above the head, at the same time drawing back the right foot.
4. Bring the bar-bell smartly down to position of attention.

Fig. 107.

Exercise 3.

1. Bar-bell above the head, same as in previous exercise (*vide* fig. 107).
2. The right-hand pupil turns to the right, releasing the left hand from the bar-bell, whilst the left-hand pupil turns to the left, releasing the right hand,

and the bar-bell is then dropped to the sides. The pupils in this position will be back to back (*vide* fig. 108).

3. Reverse movement 2—*i.e.*, the bar-bell to be raised above the head, both pupils then turning to the front and grasping the bar-bell as in previous movement 1.
4. Bring down the bar-bell smartly to first position (*vide* p. 158).

Fig. 108.

Exercise 4.

1. Bar-bell above the head, same as in previous exercise (*vide* fig. 107).
2. The right-hand pupil turns to the left, releasing the right hand from the bar-bell, whilst the left-hand pupil turns to the right, releasing the left hand. The bar-bell is then dropped to the side. The pupils in this position will be facing front, back hollow (*vide* fig. 109).
3. Reverse the movement 2—*i.e.*, the bar-bell to be raised above the head, both pupils then turning to the front and grasping the bar-bell as in movement 1.
4. Bring the bar-bell smartly down to first position.

Exercise 5.

1. Throw up bar-bell, as in previous exercises (*vide* fig. 107).
2. Right-hand pupil steps back with right foot, bringing the

bar-bell down in front at the same time as the right-hand

FIG. 109.

pupil steps forward with right foot, bring the bar-bell down the back (*vide* fig. 110).

FIG. 110.

3. Reverse movement 2, bringing pupils into same position as at close of movement 1.
4. Bring down the bar-bell smartly to first position.
5-8. Repeat the same movements, but with right-hand pupil stepping forward and left-hand pupil stepping back, releasing grasp. (This exercise can be varied by the one pupil stepping to the right or left front whilst the other steps to the left or right rear alternately.)

Exercise 6.

1. Throw up bar-bell as before (*vide* fig. 107).
2. Both pupils turn to the right, and lunging with right foot, the left-hand pupil bringing the bar-bell down in front of body, right-hand pupil bringing it down behind (*vide* fig. 111).
3. Both pupils turn to the front, bringing back the bar-bell to first position, as in fig. 107.
4. Both pupils turn to the left, right-hand pupil, releasing and grasping bar-bell again in turning, brings bar-bell down in front, the left-hand pupil down the back (*vide* fig. 112).
5. Both pupils return to fig. 107.
6. Return to ready.

Repeat movements 1 to 6, bring bar-bell smartly to first position.

Exercise 7.

1. Throw up bar-bell as before (*vide* fig. 107).
2. Both pupils turn inwards, right-hand pupil releasing right hand and replacing it in position of left on opposite side of bell, left-hand taking place of right (*vide* fig. 113). The bar-bell is then dropped to finish.
3. Both raise bar-bell above head, the right-hand pupil stepping forward with right foot, pushing bar-bell forward, while left-hand pupil steps back with left foot, bringing bar-bell down behind back (*vide* fig. 112).

FIG. 111.

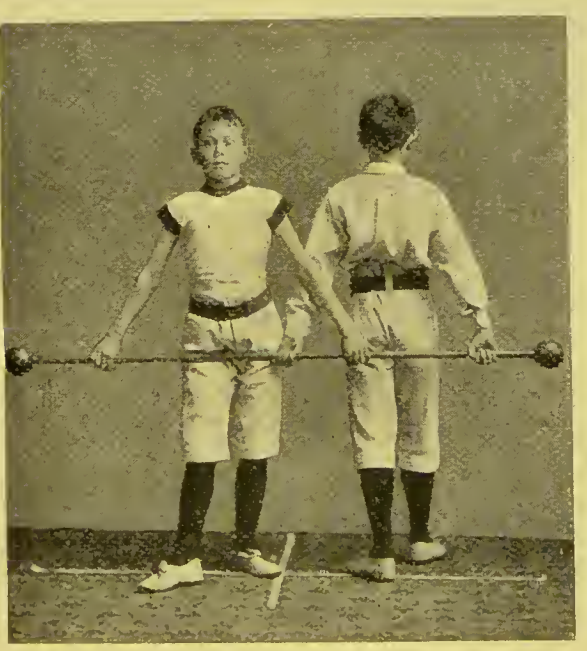


FIG. 112.

4. Return to position 2, bringing heels together.
5. Both raise bar-bell as in 3; the left-hand pupil steps forward with the right foot, pushing the bar-bell over the head of the right-hand pupil, at same time the latter steps back with the left foot, bringing bar-bell down behind the back.

Fig. 113.

6. Return to position 2.
   Repeat movements 3 to 6.
7. Both pupils turn to the front, reversing movement 2.
8. Bring bar-bell smartly down to first position.

Exercise 8.

1. Both pupils throw bell above head as before.
2. Right-hand pupil releases bell, both turn back to back, left-hand pupil maintaining bell above head, right-hand pupil coming to attention.
3. Right-hand pupil grasps bell, and both step with right foot (*vide* fig. 114).
4. Bell is brought down behind back and right feet are drawn back (*vide* fig. 115).
5. Return to 3.
6. Return to 2.
7. Return to 1.
8. Attention.

9-16. Repeat 1 to 8, left-hand pupil now doing work of right, and *vice versâ*.

Exercise 9.

1. Throw bell above the head as before (*vide* fig. 107).
2. Both pupils turn back to back, the right-hand pupil relinquishing the bar-bell and grasping it again above the head after the turn is made, as in fig. 114.

Fig. 114.

Fig. 115.

3. Right-hand pupil lunges with right foot a pace to the right front, and left-hand pupil lunges with left foot a pace to the left front (*vide* fig. 116).
4. Bring bell to attention.
5. Both throw up bell, stepping or lunging with left foot.
6. Return to four.
7. Throw up bell and turn front, right-hand pupil releasing and recovering bell as before.
8. Attention.

9-16. Same as 1 to 8, with left-hand pupil taking work of right.

Exercise 10.

1. Both throw up bell as before (*vide* fig. 107).
2. Both turn back to back (*vide* fig. 114), but without stepping.
3. Step right, as in fig. 116, bringing bell down back.
4. Return to 2.
5. Step left, as in fig. 116, bringing bell down back.

Fig. 116.

6. Return to 2.

3 to 6 may be repeated as often as desired.

7. Return to position 1.
8. Attention.

Exercise 11.

1. Pupils throw up bell as before.
2. Pupils turn back to back close together (*vide* fig. 114).
3. Left-hand pupil brings bar-bell down over front of chest of right-hand pupil.

4. Return to 2.
5. Right-hand pupil brings bell down in front over chest of left-hand pupil.
6. Return to 2.
7. Front turn to 1.
8. Attention.

This exercise—the double dislocation—must be performed very carefully.

Exercise 12.

1. Throw up bell as before, except that hands of pupils do not cross. Fig. 117 shows attention.

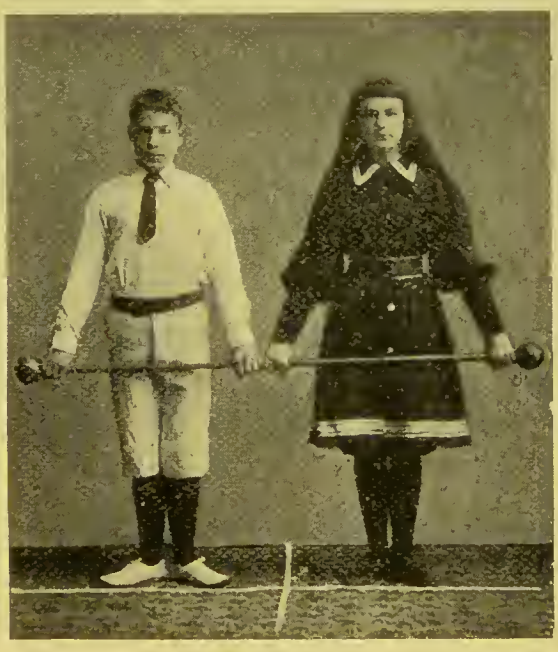


Fig. 117.

2. Both step to the rear with right feet.
3. From 2 lunge to the rear, bringing bell to ground in front of toes.
4. Rise smartly to attention.

5-8. Repeat 1 to 4, with left foot lunging.

Exercise 12 (*inwards*).

Repeat Exercise 12, facing each other.

1. Throw up bar-bell above heads.
2. Turn inwards and release grasp.
3. Both pupils lunge to the rear with right feet and touch toes with bell, as in fig. 118.

Fig. 118.

4. Up smartly to attention, facing each other.
5. Lunge with left feet to the rear.
6. Up smartly to attention as in 4.
7. Both pupils turn front as in 1.
8. Come to attention.

Exercise 12 requires more floor-space than some of the preceding ones.

Exercise 13.

1. Throw up bar-bell as in fig. 107, right-hand pupil's left arm crossing over right arm of left.
2. Pupils turn face to face, turning down right hands until the bell is perpendicular.

Right-hand pupil stepping to the left with left foot, left-hand pupil right with right foot (*vide* fig. 113).

3. Right-hand pupil turns left about, the head passing under bell, finishing with feet together.
4. Right-hand pupil turns right about again, bringing bell over head and down to position 2, the bell, however, being now reversed from that position.
5. Left-hand pupil turns right, bringing bell up and then down behind back.
6. Left-hand pupil turns right about, bringing up left-hand end of bell, his head passing under bell to position 2.
7. Raise bell to position 1.
8. Attention.

FIG. 119.

9-16. Repeat 1 to 8 on opposite side. Left-hand pupil must now have right hand above left hand of pupil to right.

Exercise 14.

1. From attention drop bell to perpendicular between pupils, right-hand pupil grasping with left hand, left-hand pupil with right, near top of bell.
2. Right-hand pupil with right foot, left-hand pupil with left, lunge diagonally to rear, heads up, backs hollow, free arms extended upwards diagonally to rear, as in fig. 119.

3. Return to position 1.
4. Both pupils about turn inwards, exchanging grasp of hands.
5. Repeat 2 on opposite side.
6. Return to position 4.
7. Both pupils about turn inwards to position 1.
8. Attention.

This exercise can be done with the pupils grasping the bar-bell with both hands, putting toes of right or left feet at lower knob of bar-bell, arms straight. Both hands are kept on bell while each pupil steps to the rear, keeping a strong pull on the bar-bell. The pupils must be careful to retain their grasp throughout the movement (*vide* fig. 120).

Fig. 120.

The exercise which is called in Scotland the "Sweer-Trie" (*i.e.*, Stiff Test), and that generally known as "Cock-fighting," can be employed as an amusing and healthy variation of the regular work. The strengthening effects of these exer-

cises upon girls is really wonderful, and they might well be introduced more freely by instructors when the ordinary class work has been done. The accompanying figures give a very fair idea of these movements. The object in the one case is clearly to pull (*vide* fig. 121), and in the other to push, the

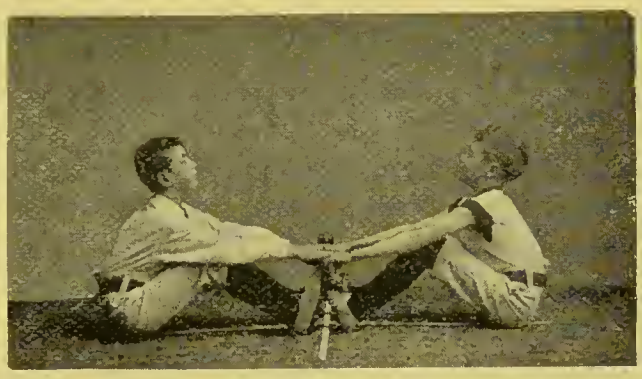


FIG. 121.

opponent over without losing one's own position (*vide* fig. 122).

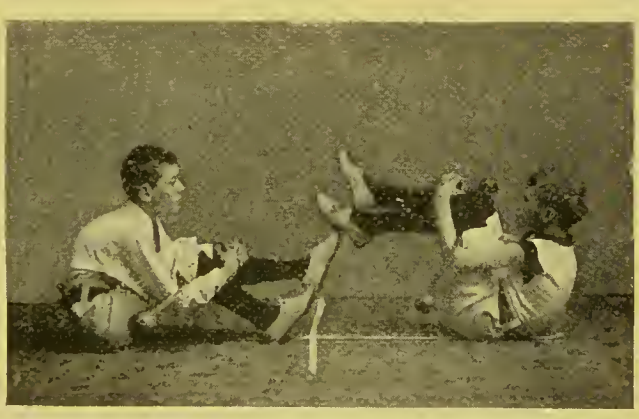


FIG. 122.

BALL EXERCISES.

(For Music, *vide* p. 228.)

These exercises are good for training the conjoint action of the hands, eyes, and ear, and for making the pupils ambidextrous. A hollow india-rubber ball of good quality and about the size of a cricket-ball is suitable. For effect the balls should be self-coloured—*e.g.*, red. Each group of four pupils forms a unit in the drill—*i.e.*, 1 to 4 act together, 5 to 8, and 9 to 12. Every exercise has 32 bars of music in each part. If a ball leaves the ranks, the instructor returns it.

Fall in.
Two deep.
Number.
Extend to full intervals.

Vide p. 74 or p. 76. Pupils should carry the balls in their right hand.

Vide p. 94.

Extend for ball drill—March.

On the word *March*, the front rank takes a pace to the front with the left foot and the rear rank a pace to the rear.

Front rank about—Turn.

Front rank turns to right about so as to face rear rank.

Ready.

On the word *Ready*, the pupils at a chord from the piano will bend the right arm, so that the back of the head is in front of the right shoulder.

Exercise 1.

One.

On the word *One*, the pupils in the front rank bounce their balls on the floor to the right of the pupils of the same number in the rear rank. At the same time the pupils of

the rear rank bounce their balls to those of the front rank (*vide* fig. 123).

The pupils catch the balls with their right hands, palms uppermost, and smartly reverse their hands (*vide* fig. 124).

Fig. 123.

Fig. 124.

Repeat 16 times, and then change balls to left hands. Repeat 16 times with left hands.

Exercise 2.

One. On the word *One*, the front-rank pupils bounce their balls with the right hand to the left of their rear-rank pupils. At the same time the rear-rank pupils *about turn* smartly to the right and catch the ball with their right hands, palm downwards.

Two. On the word *Two*, rear rank about turns so as to face front rank.

Repeat 16 times. Repeat with rear rank bouncing ball. Then repeat whole exercise with opposite hands.

Exercise 3.

One. On the word *One*, No. 1 bounces the ball on the floor with the right hand to the right

FIG. 125.

of No. 4, who catches it with the right hand palm downwards (*vide* fig. 125).

Two. On the word *Two*, No. 3 bounces the ball on the floor with the right hand to the right

of No. 2, who catches it with the right hand, palm downwards.

Repeat 16 times.

Three. On the word *Three*, Nos. 1 and 3 bounce their balls on the floor at the same time to Nos. 4 and 2 respectively, taking care that No. 1 bounces the ball low and No. 3 high.

Four. No. 4 and No. 2 return the balls in same way to No. 1 and No. 3, No. 4 bouncing high and No. 2 low.

Repeat 16 times. Then repeat whole exercise with opposite hands.

Exercise 4.

No. 1 throws the balls with a high circle across to right of No. 4, and No. 3 with a low circle to No 2, the balls being caught by No. 4 and No. 2 with right palms upwards.

No. 4 and No. 2 sharply reverse hands and throw to No. 1 and No. 3 respectively.

This is done in schottische time 16 times. The exercise may be repeated with the left hands.

Exercise 5.

About—Turn. On the word *About Turn*, the front and rear ranks will about turn, so that they are back to back.

One. On the word *One*, the front rank will bounce the balls on the floor straight to the rear with the right hands, and the rear rank will catch the balls with the left hands, palms downwards.

Two. On the word *Two*, the rear rank bounce the

balls with their left hands to the front rank, who catch them with their right hands, palms downwards (*vide* fig. 126).

Repeat this 16 times.

About—Turn. Repeat above exercise 16 times facing each other. The exercise may then be done with the front rank leading off with the left hand, or both ranks bouncing their balls with the same hands at the same time.

FIG. 126.

Exercise 6.

One. On the word *One*, the pupils in the front rank bounce the ball with the right hand, so as to make it rise straight up, and quickly turning to the right about a complete circle, catch the ball again with the right hand, palm down.

At the same time the rear rank bounce with the left hand, turn a complete circle to the left bout, and catch the ball with the left hand.

Repeat 16 times. Then repeat with opposite hands.

Exercise 7.

One. On the word *One*, the pupils in the front rank bounce the ball on the floor with the right hand and step two paces smartly backwards.

At the same time the pupils in the rear rank step two paces smartly forwards and catch the ball with the right hand, palms downwards, on the second rebound of the ball.

The time of marching and the time of the rebounds of the ball must be the same—*i.e.*, 1, 2 catch the ball.

Two. On the word *Two*, the pupils in the rear rank bounce the ball with the right hand and step back two paces, while the pupils in the front rank step forward two paces and catch the ball with the right hand.

Repeat 16 times. Then repeat with left hand.

Exercise 8.

Front rank about—Turn. On the word *Turn*, both ranks bounce their balls with the right hand in quick time, and continue bouncing them for 16 beats, while the front rank fronts.

In single rank close order—March. On the word *March*, given at the commencement of the second 16 beats, the rear rank step at quick time forward, so as to form single rank. All meanwhile bouncing their balls in time with the music.

Halt. On the word *Halt*, the pianist gives an extra chord, all the pupils throw their balls in the air a little above their heads, clap their hands, catch the balls with the palms of both hands, and come smartly to attention with the balls in the right hand.

BALANCING DRILL.

These exercises strengthen the muscles for maintaining the erect position, and give ease and gracefulness of carriage.

Any suitable article is balanced on the top of the head. Often this is a self-coloured cloth bag full of sawdust or a smaller one of sand, or it may be a baker's leather ring or a calisthenic birch ring. The Italians use a light empty basket.

Each exercise should be done to 32 beats of music.

Size in single rank, or two deep. *Vide* p. 76 or p. 77.

Extend to full intervals—March. *Vide* p. 94.

Ready. On the word *Ready*, balance the bag on the head, come to attention.

For Arm Exercises.

Exercise 1.

1. Raise the extended arms in front to the level of the shoulders, palms of the hands touching.
2. Sweep the extended arms backwards as far as possible at level of shoulders (*vide* fig. 127).
3. Bring extended arms down to attention.
4. Pause, then repeat four times.

Repeat on tiptoes.

Exercise 2.

1. Elevate extended arms sideways until the backs of the hands touch above the head.
2. Bring extended arms down to attention.

Repeat 8 times. Repeat on tiptoes.

Exercise 3.

1. Circle extended arms in front upwards and backwards to attention for 8 times.
2. Repeat on tiptoes.

Then repeat backwards and to the right and to the left.

For Leg Exercises.

Ready. Place hands on hips, fingers to front, thumbs to rear.

Exercise 4.

1. With body erect, kneel slowly on both knees.
2. Rise slowly to erect position.

Repeat 16 times.

Exercise 5.

1. Raise extended right leg in front to right angles with body (as far as possible).
2. Return leg slowly to position of attention.

Repeat 8 times. Repeat with left leg (*vide* fig. 128).

Exercise 6.

1. Raise extended right leg sideways as high as possible (*vide* fig. 129).
2. Return leg slowly to position of attention.

Repeat 8 times. Repeat with left leg.

Attention. Bring hands to attention.

Exercise 7.

1. Lunge with right foot to B, throwing arms into extension diagonally, right upwards and left downwards.
2. Attention.

Repeat 8 times. Repeat with left foot to H.

For Marching Exercises.

Right close—	*Vide* p. 91.
March.	
Right—Turn.	*Vide* p. 80.
Quick march	*Vide* p. 100.
—Change.	
March on toes	*Vide* p. 100.
—Change.	
Hopping	*Vide* p. 101, and fig. 130.
march—	
Change.	
Gymnastic	*Vide* p. 102.
March—	
Change.	
Gymnastic	*Vide* p. 104.
March.	
At double.	
Form file.	
Halt. Front.	

FIG. 127.

FIG. 128.

FIG. 129.

FIG. 130.

SKIPPING DRILL.

(For Music, *vide* p. 233.)

These exercises call into action a large number of the muscles of the body, and are therefore especially useful for developing the capacity of the lungs. They also increase the co-ordination of the muscles of the arms and legs.

Each exercise should be done to 32 beats of music. Until the first exercise is commenced, the ropes should be looped diagonally across the right shoulder or round the waist in a half hitch, the handles dangling to the left.

Arrangement of Class.

Size in single rank. *Vide* p. 77.

Number On the word *Number*, the line numbers from right to left into units of six—*i.e.*, 1, 2, 3, 4, 5, 6, then 1, 2, 3, 4, 5, 6, and so on.

For Skipping Drill.

Right—Turn. *Vide* p. 80.

March. On the word *March*, the pupils, dancing with two hops and a skip to the left and right alternately, form a half circle round the hall, to the left.

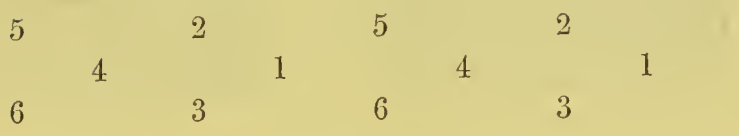
Extend. On the word *Extend*, the first No. 1 halts and right turns, the others passing on the right diagonally to the rear. At four paces to the right and four paces to the rear of No. 1, No. 2 halts and right turns; the line, circling by the rear, passes on the right of No. 2, and advances straight to the front for eight paces,

where No. 3 halts; the line, circling in front, passes diagonally to the rear eight paces to the right of No. 2. When four paces are taken, No. 4 halts, turning to the right about, the line passing to the right. At the rear—*i.e.*, in line with No. 2—No. 5 halts and fronts; the line, circling to the rear, passes to the right of No. 5, and advances in a straight line eight paces to the front, where No. 6 halts.

The rest of the pupils continue to form similar units in a continuous series.

When completed, the pupils forming each rank are all eight paces apart, and the three ranks as a whole are separated by intervals of four paces.

The following diagram shows the arrangement of the class in extension in the case of twelve pupils:—



Many dancing steps are suitable for skipping exercises. The following selection is a good combination. When the class is in position the ropes should be loosened, and held in readiness for skipping at a signal from the piano (*vide* fig. 131).

One. On the word *One*, skip, meanwhile dancing the step known as "point behind point before" (*vide* fig. 132).

Two. "Rock step" of the Highland Fling.

Three. "Toe-and-heel step."

Four. "Two shuffles in front and two toe-beats behind."

Five. "The Yorkie step" (first reel step).
Six. "Double balance step (third reel step).
Seven. "Sachet to side."
Eight. "Heel toe with left and right, three steps alternately" to either side.

FIG. 131.

FIG. 132.

Halt, re-form into line—March. Reverse of extension march.

N.B.—These skipping exercises can also be done with half hoops or canes.

INDIAN CLUB EXERCISES.

Indian club exercises are especially beneficial in training the co-ordination of the muscles of the upper limbs, in cultivating precision and grace of movement, and in developing attention

and the memory of motor acts. They can be performed at home or in a schoolroom or gymnasium. Light clubs ought to be used.

The essential movements of all club exercises consist of swinging the clubs into the various positions of extension, and circling them either outwards, downwards, inwards, and upwards, or inwards, downwards, outwards, and upwards, vertically in a transverse plane of the body, or of rotating them by a wrist movement when held upside down, with the arms extended at the line of the shoulder, either from within outwards, backwards, and forwards, or from without inwards, backwards, and forwards, in a horizontal plane.

The vertical circles may be made—

1. By a motion of the wrist alone, sweeping the club in front of the wrist or behind the wrist. These are known as wrist-twists.
2. By movements of the wrist and elbow-joint, the upper arm being fixed. These are known as short circling, and can be done in front of the chest or behind the shoulders.
3. By movements of the wrist and shoulder-joint, the arms being fully extended. These are known as long circling, and can only be done in front of the body.

To put it in a tabular manner, circling, with the balls of the clubs up, may be done in the following ways :—

1. Front wrist-twist, with right hand downwards, to left or right or to the front or to the chest.
2. Back wrist-twist, with right hand downwards, to right or left or to the front or to the chest.
3. Front short circle, with right hand downwards, to left or right.
4. Back short circle, with right hand downwards, to left or right.
5. Long front circle, with right hand downwards, to left or right.

With the left hand similar movements are executed.

EXTENSION FOR CLUB EXERCISES.

Method I.

Extension in position.

Form company two deep. *Vide* p. 76.

Number.

Open order —March. Rear rank steps two paces to the back.

To open out —March. Odd numbers of both ranks take a pace to the front with left foot, and even numbers a pace to the rear.

Method II.

Extension in position. *Vide* pp. 94 to 96.

Method III.

Opening out.

March.

Form company two deep. *Vide* p. 76.

Number.

Open order —March. Rear rank steps two paces to the rear in quick time.

Right-turn —March. On the word *March*, the files march a given number of paces to the right flank, or, if for display, the files march to the right-flank limit of the schoolroom, wheel by the left, marching three-fourths of a circle round the room, and then march in a straight line to the front. At a given number of paces to the right-flank, or to the front, as the case may

be, the leading pupils halt. The remainder of the files march inside the leading pupils, and as they pass them the front or left rank circles a left-about turn, and the rear or right rank circles a right-about turn. The second pupils having turned about, halt one pace in rear and two paces to the outer flanks of their respective leading pupils. The third pair halt one pace in rear of the second pupils, but in line with their respective leading pupils. The fourth pair halt one pace in rear of the third pupils, but in line with the respective second pupils, and so on, thus forming four lines or files, the odd numbers forming the two central lines and the even numbers the outer lines (*vide* diagram below).

Re-form two deep—March. On the word *March*, the front-rank pupils right turn and the rear rank left turn, and No. Ones standing fast, the others, circling round the flank, march in two files between them and take up their original position in extended order but facing to the left.

Front. Close order —March. Right turn.

Rear rank two paces forward—March.

1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8

COMBINATION OF EXERCISES FOR JUNIOR PUPILS.

(For Music, *vide* p. 235.)

These exercises should be done to 32 beats of music, and should follow each other consecutively.

Ready. Club held as in fig. 133. Side step to right —13½ inches.

Exercise 1.

Holding both clubs vertically with globular ends upwards, forearms bent at right angles to the front, elbows close to the side (*vide* fig. 133), extend both arms upwards to the right (*vide* fig. 134), and with a pendulum-like motion swing the clubs, with extended arms in front of the body, downwards and then upwards to the left.

Repeat this movement from the extended position, swinging the clubs from left to right. Repeat for 8 times.

At commencement of second 8 beats circle the extended right arm in a long circle downwards to the left, at the same time swinging the extended left arm below the right from left to right (*vide* fig. 135).

Repeat circling with the left hand and swinging with the right.

Drop arms to sides, clubs pointing downwards.

Exercise 2.

1. Swing arms in extension to right in line with shoulder, then swing both arms in front downwards to left, up to line of left shoulder.

Repeat 8 times.

2. Long circle with right downwards to left, keeping left swinging as in 1 (*vide* fig. 135).

FIG. 133.

FIG. 134.

FIG. 135.

FIG. 136.

3. Return to 1.
4. Long circle with left downwards to right, keeping left swinging.

Return to 1 and drop to attention. Repeat with right hand. Come to attention.

Exercise 3.

1. Extend arms and clubs upwards to right.
2. Throw the right arm across the chest, club pointing horizontally in the line of the left shoulder, and swing at same time the left arm behind the body into the hollow of the back, club pointing to right shoulder (*vide* fig. 136).
3. Extend both clubs horizontally sideways.

FIG. 137.

FIG. 138.

4. Reverse of 2.
5. Extend both clubs horizontally sideways.
6. Swing both hands behind to the hollow of the back, pointing right club to left shoulder and left club to right shoulder, right hand behind (*i.e.*, above) left (*vide* fig. 137).

7. Extend both clubs sideways in line with their respective shoulders.
8. Bend both arms across body with clubs pointing upwards. (Fig. 138 shows clubs coming upwards.)
9. Extend and repeat to left.
10. Attention.

Exercise 4.

From attention.

1. Wrist-twist downwards to right with right, and then extend right straight above head.
2. Swing right downwards to right to position of attention.
3. Wrist-twist downwards to left with left, and then extend left straight above head.
4. Swing left downwards and left to position of attention.

Fig. 139.

When these movements have been learned separately, repeat them thus in combination. Wrist-twist the right to right and elevate above head, and when right is elevated, wrist-twist the left to left. Swing the right downwards to attention, when elevating the left to above head (*vide* fig. 139).

Exercise 5.

From attention.

1. Pupil half turns to right, swinging up both clubs in extension to right, and cracks the clubs together, meanwhile looking well up (*vide* fig. 134).
2. Right hand makes a large circle downwards to rear, and bringing it up, cracks the other club in position 1.
3. Left hand makes a large circle downwards to rear, and bringing it up, cracks the other club in position 1.
4. With both hands held together wrist-twist the clubs downwards to the front behind the wrists, and bringing them them up, crack together as before.

Left about. Repeat 1 to 4 on opposite side.
Attention. Come to attention.

Exercise 6.

From attention.

1. Swing both clubs upwards to extension at the right side (*vide* fig. 134).
2. Wrist-twist both clubs downwards and forwards behind the wrist, and sweep clubs downwards in extension to above head, cracking the clubs together (*vide* fig. 140).
3. Extend both arms sideways to level of respective shoulders, wrist-twist downwards and outwards behind wrists, and swing clubs downwards and inwards in front of body so that the arms cross each other in front, right hand above (*vide* fig. 138).
4. Attention.

Repeat.

Exercise 7.

From attention.

1. Step one pace to front with right foot, at same time wrist-twist both clubs backwards and downwards when sweeping

arms up in front, finishing by resting clubs on shoulders, elbows raised, and looking well up.

2. Wrist-twist both clubs downwards and forwards, then bring arms in a forward sweep down to attention.

Repeat, stepping one pace to left.

Exercise 8.

Clubs resting on shoulders, hands in front.

1. With right make large circle downwards to right, returning to shoulder rest.
2. With left make large circle downwards to left, returning to shoulder rest.
3. With right making large circle downwards to right, make back short circle with left to left (*vide* fig. 141).
4. With left making large circle downwards to left, make back short circle with right to right.

Repeat.

Exercise 9.

Clubs resting on shoulders.

1. With right make large circle downwards to left.
2. With left make large circle downwards to right.
3. With right making large circle downwards to left, make back short circle or wrist-twist behind shoulders to left.
4. With left making large circle downwards to right, make back short circle or wrist-twist behind shoulders to right (*vide* fig. 142).

Repeat.

Exercise 10.

From shoulder rest.

1. Extend both arms in front at level of shoulders, keeping hands the width of the body apart, and drop clubs by circular motion inwards within arms so as to hold them

FIG. 140.

FIG. 141.

FIG. 142.

FIG. 143.

upside down—*i.e.*, balls pointing to the ground, forefingers and thumbs at the upper ends of the handles.

2. Circle clubs inwards, then outwards, to make horizontal circles, slowly carrying extended arms in line with shoulders to the right and left respectively (*vide* fig. 143).
3. At 3 the arms should be in extension sideways, the clubs still circling.
4. Slowly return to extension in front, still circling the clubs.

Repeat.

Exercise 11.

With clubs downwards, arms extended in front.

1. Raise right hand and lower left hand sufficiently to enable the right club to circle above the left hand, both hands in the same line in front. Circle both clubs inwards 16 times (*vide* fig. 144).
2. Left above right. Circle both clubs inwards 16 times.
3. Make two circles inwards with right above, then two with left above, and so on alternately.

Exercise 12.

From attention.

1. Swing arms in extension in front in line with shoulders, palms uppermost, hands width of body apart (*vide* fig. 145).
2. Wrist-twist both clubs backwards and downwards, towards chest, in front of wrists.
3. Bend both arms with back of hands to chest, clubs pointing downwards, carrying elbows outwards at line of shoulders.
4. Drop to attention.

Repeat to 32 beats of music.

FIG. 144.

FIG. 145.

FIG. 146.

FIG. 147.

Exercise 13.

From attention.

1. Swing arms above head, crossing clubs, with left hand in front of right, eyes looking well up (*vide* fig. 146).
2. Short circle clubs at back of shoulders downwards and inwards, and extend arms horizontally sideways.
3. Large circle both clubs upwards and inwards, with right hand in front of left.
4. Come to attention (*vide* fig. 133).

Exercise 14.

From attention.

1. Fully extend right arm upwards to right side, and half extend left arm across body to right side also (*vide* fig. 147).
2. Sweep both clubs downwards and upwards to left, so as to bring them to reverse position of No. 1—*i.e.*, left fully extended and right bent.
3. Short circle left downwards and inwards at back of shoulders.
4. Wrist-twist right club downwards and backwards, at same time twisting body to right side, so as to return to position 1 (*vide* fig. 147).

This is known as "The Wheel with Wrist-twists."

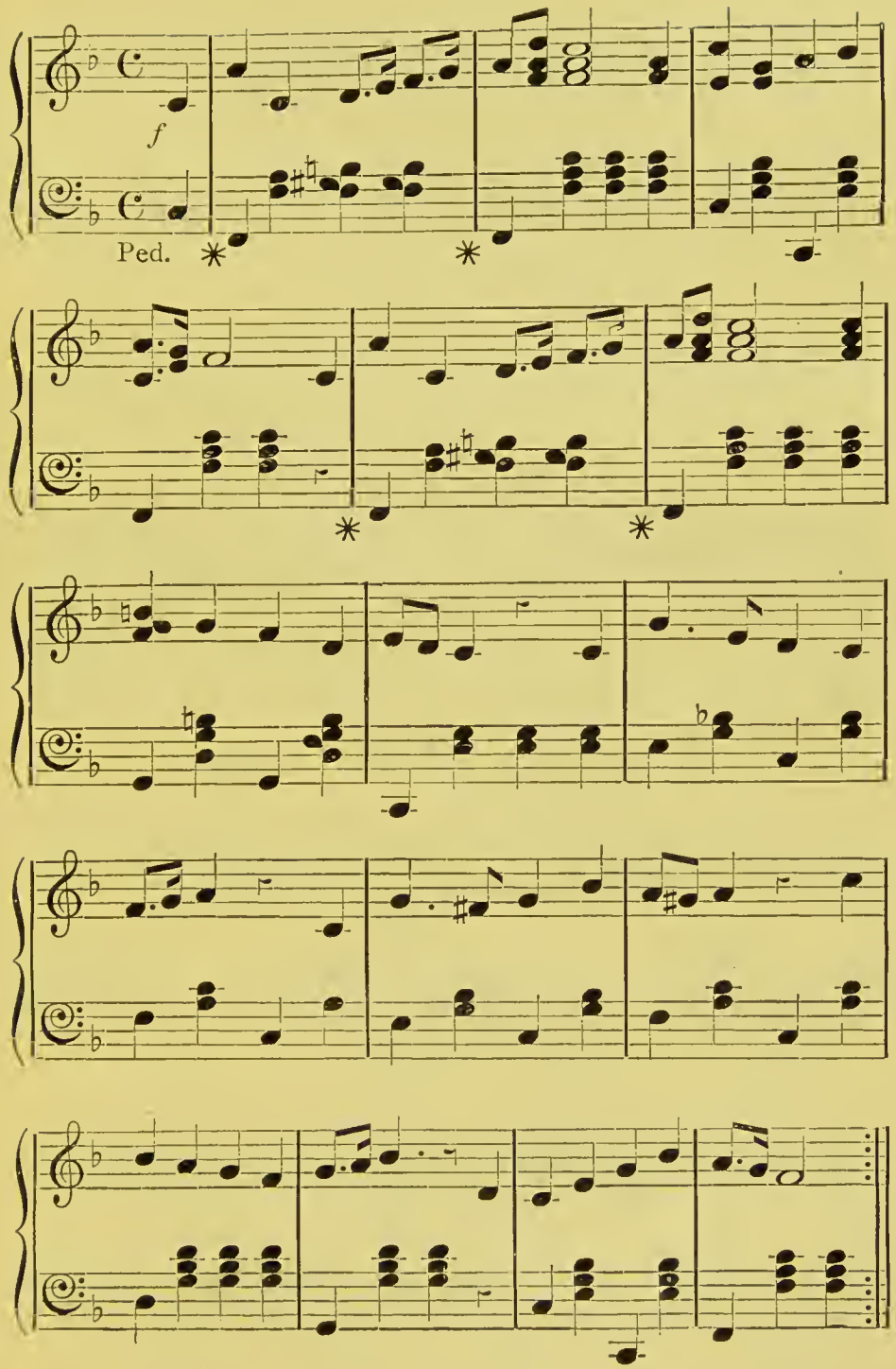
PART III.

MUSICAL ACCOMPANIMENTS

BY

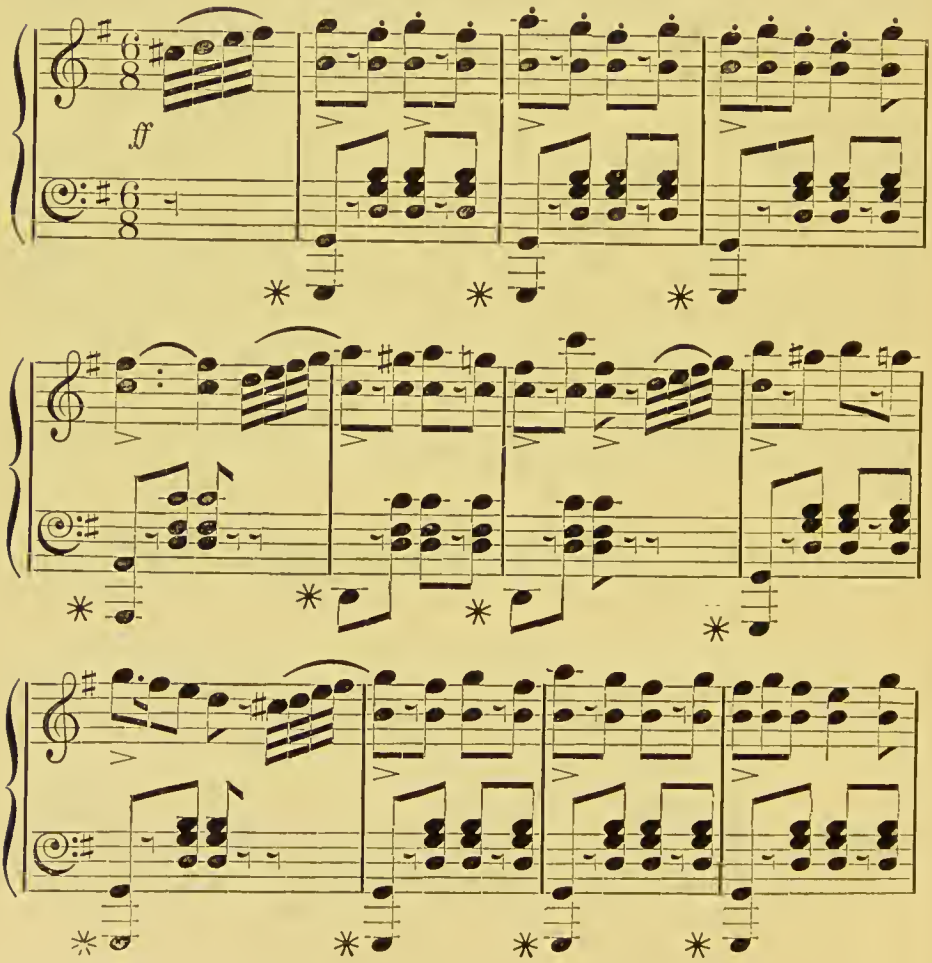
HARRY EVERITT LOSEBY

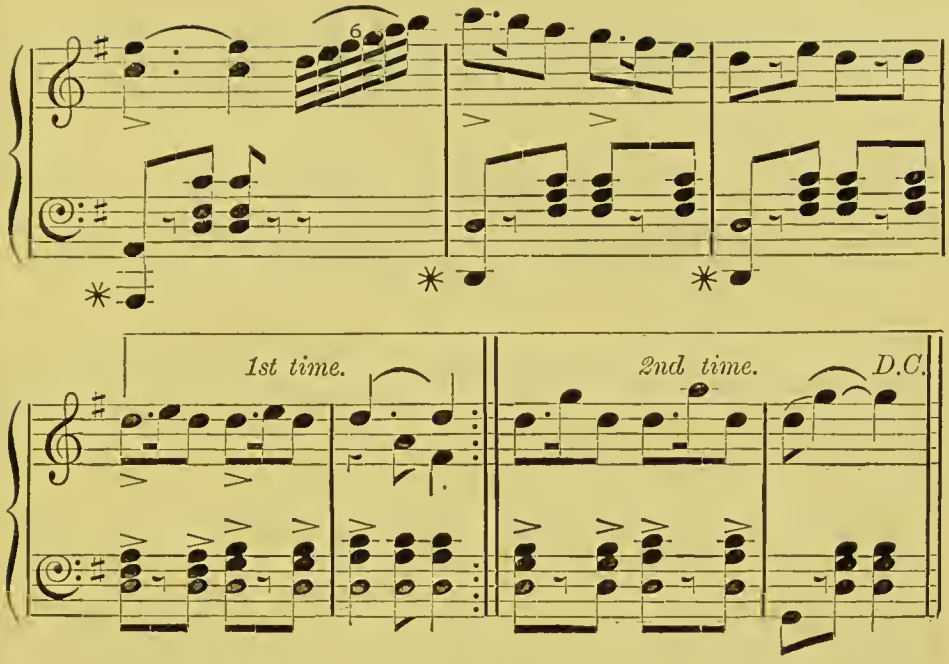
No. 1. SLOW MARCH (*vide* p. 88).



No. 2. QUICK MARCH (*vide* p. 90).

COMBINED MARCHING DRILL. HOP-AND-KICK MARCH (*vide* p. 103).

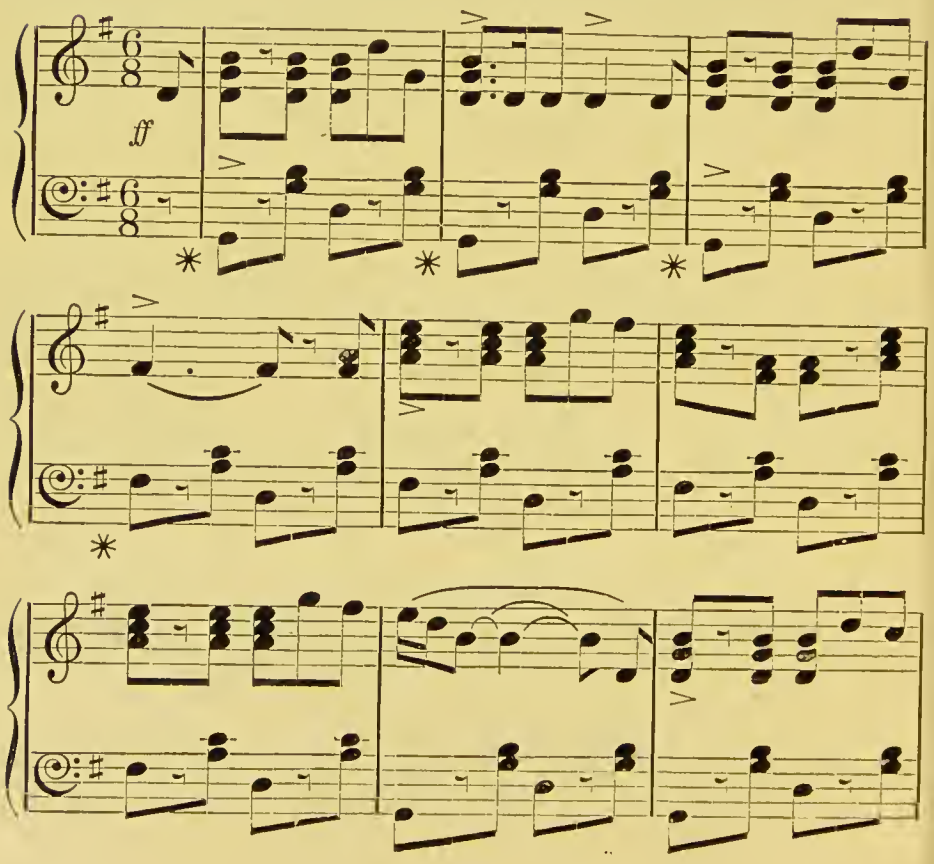


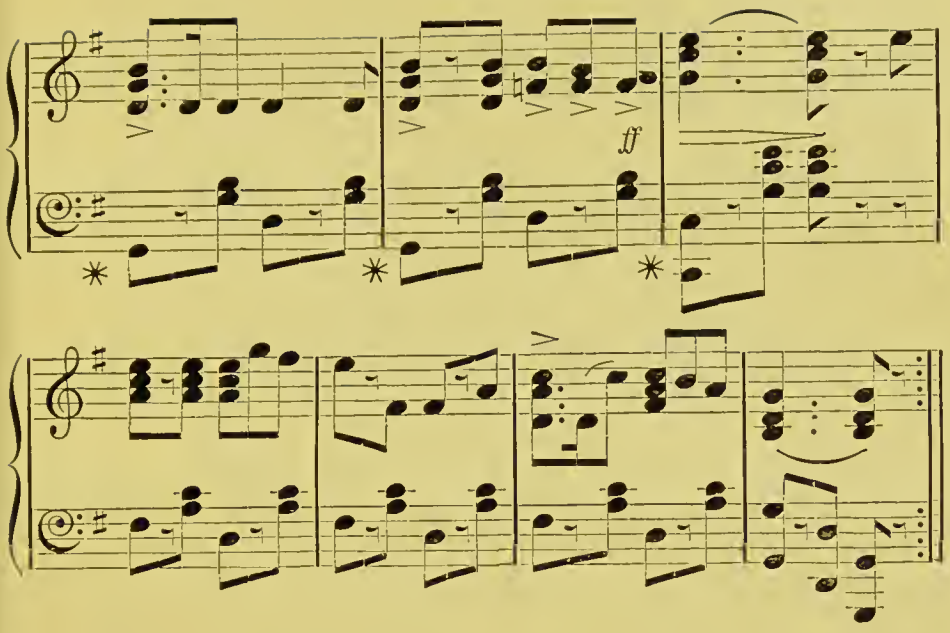

6
1st time.
2nd time.
D.C.

COMBINED MARCHING DRILL.

No. 3. MILITARY MARCH (*vide* p. 100).

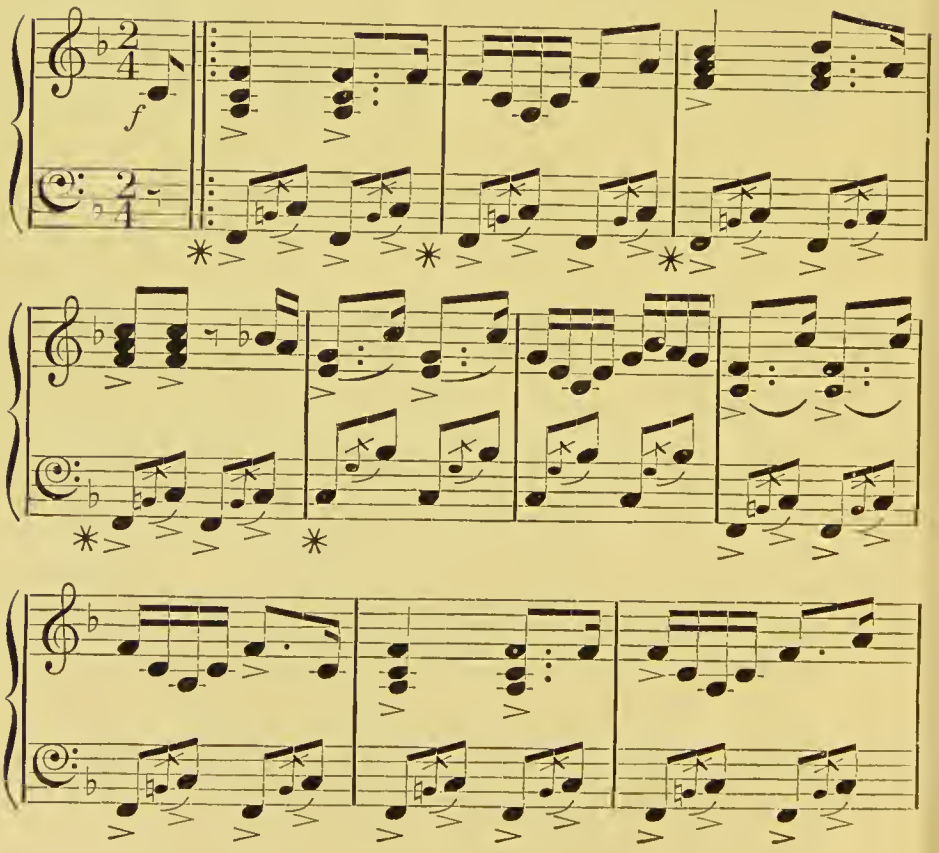
DOUBLE MARCH (*vide* p. 104).

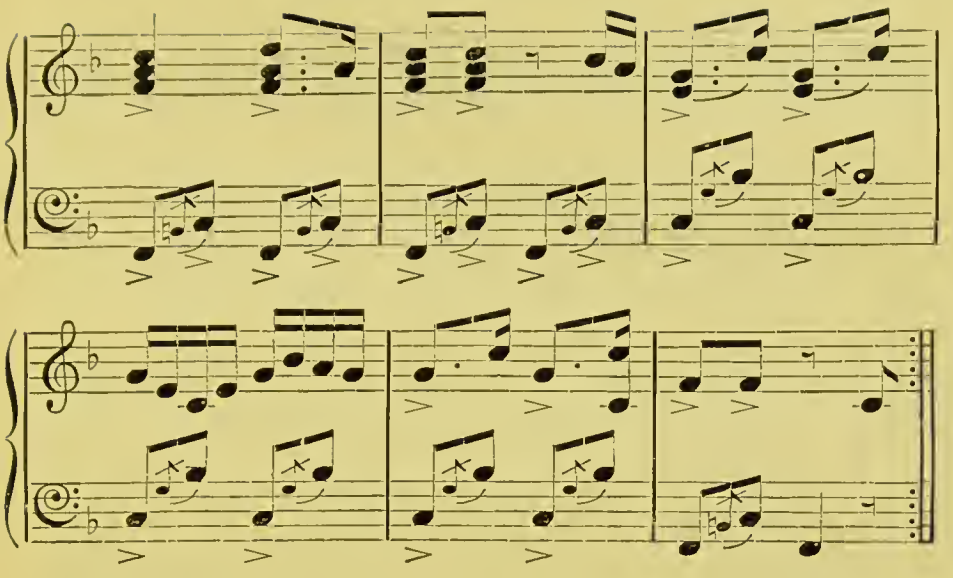



ff

COMBINED MARCHING DRILL.

No. 4. MARCHING ON TOES (*vide* p. 100).

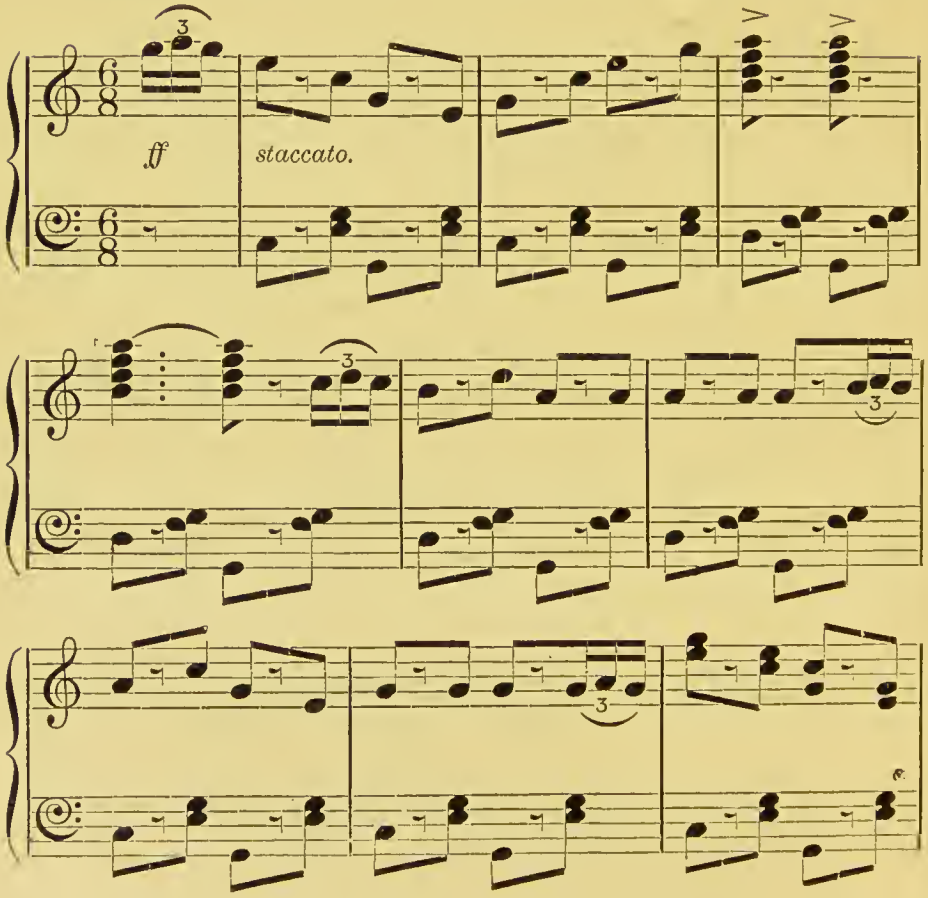


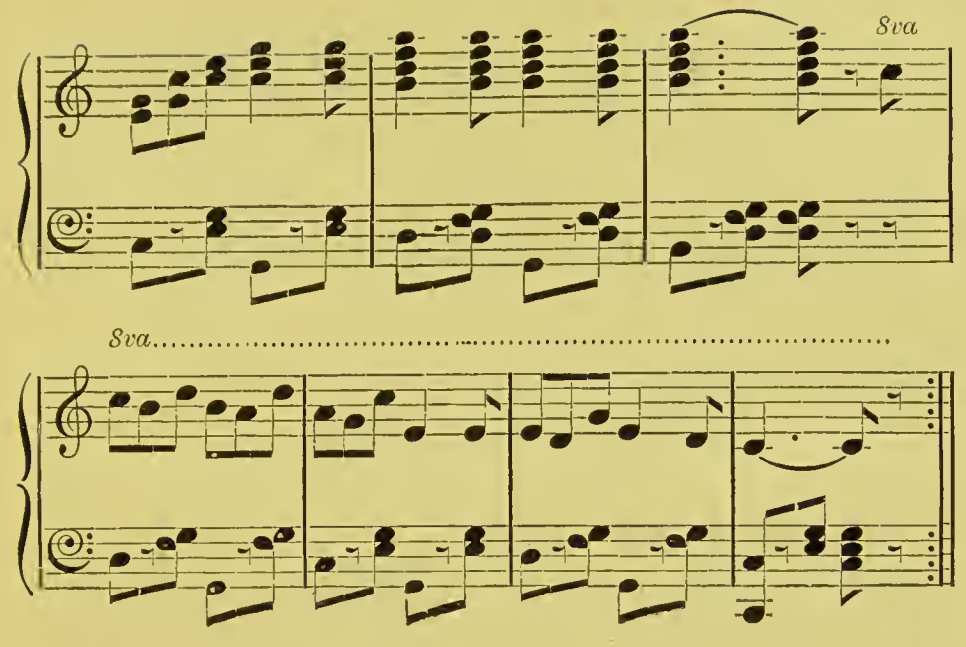


COMBINED MARCHING DRILL.

No. 5. HOPPING MARCH (*vide* p. 101).

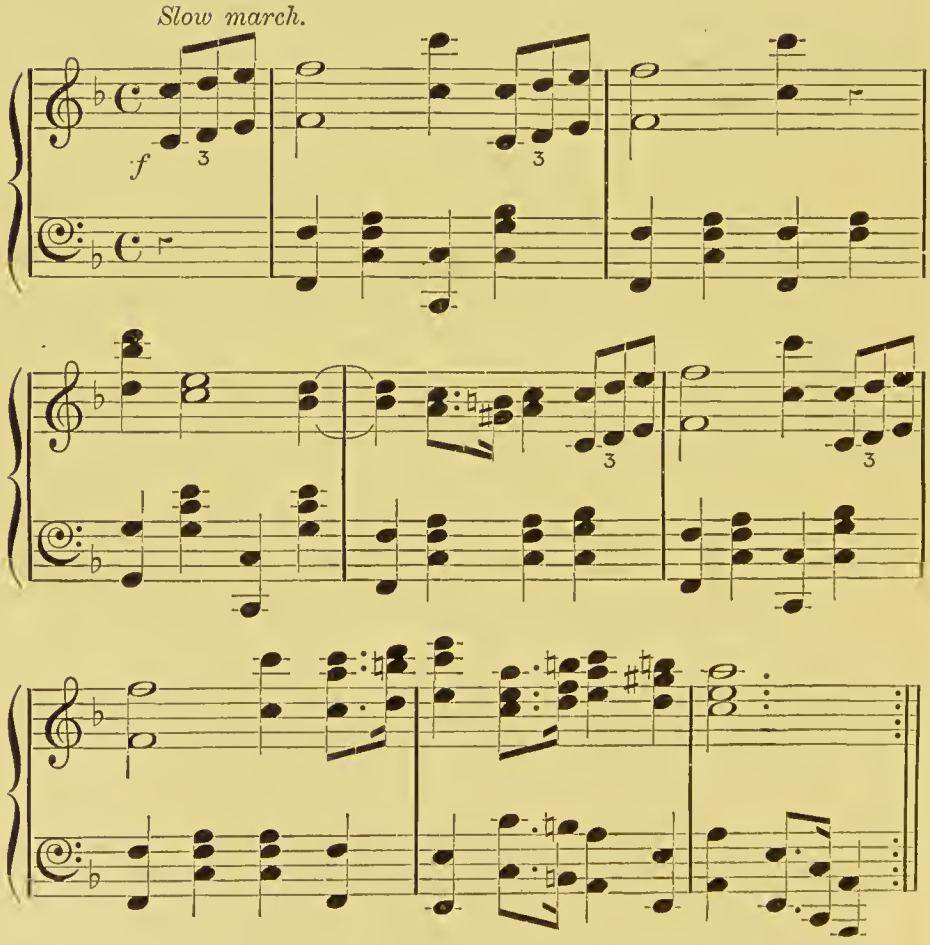
DOUBLE GYMNASTIC MARCH (*vide* p. 104).

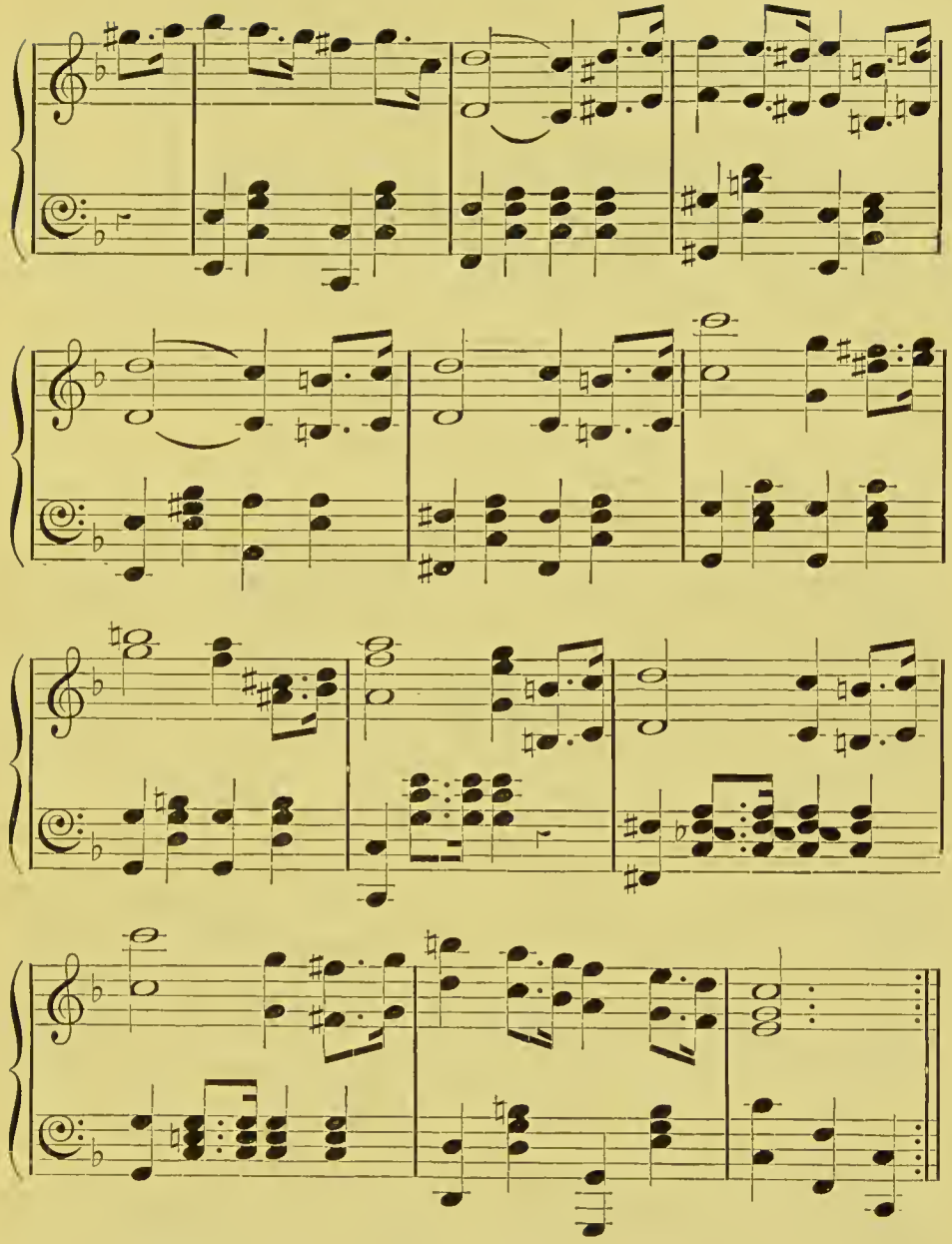



8va
8va

COMBINED MARCHING DRILL.

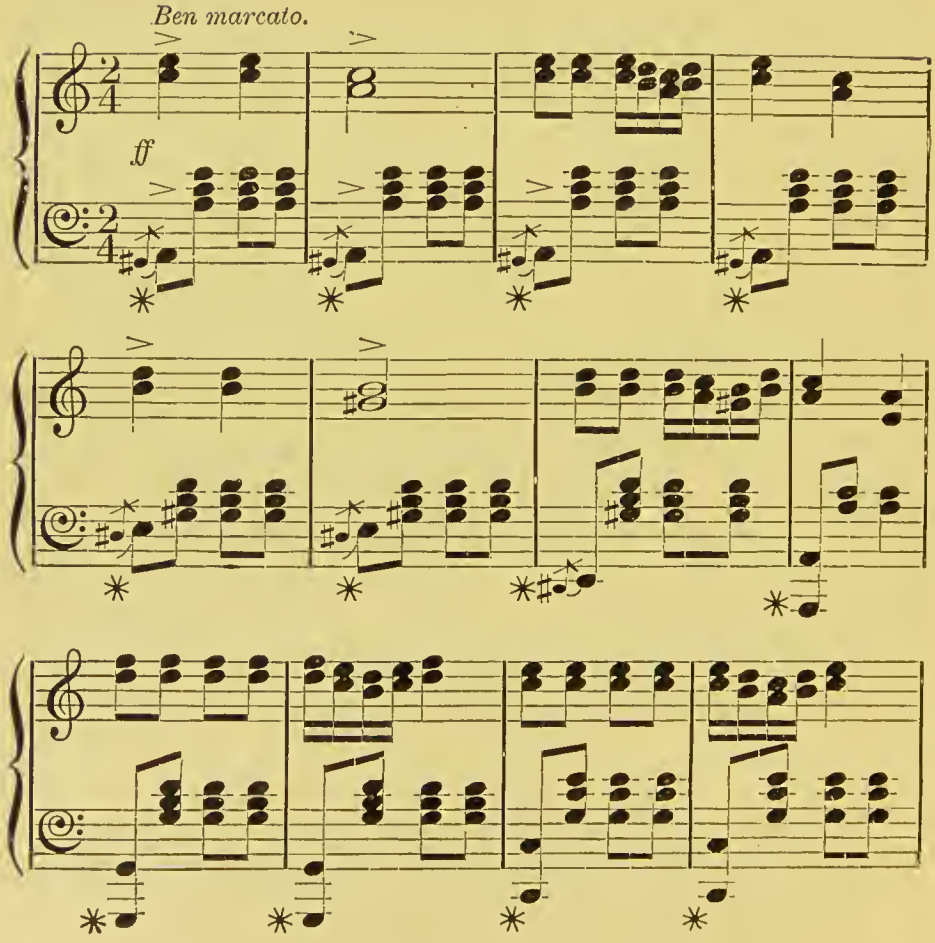
No. 6. GYMNASTIC MARCH (*vide* p. 102).

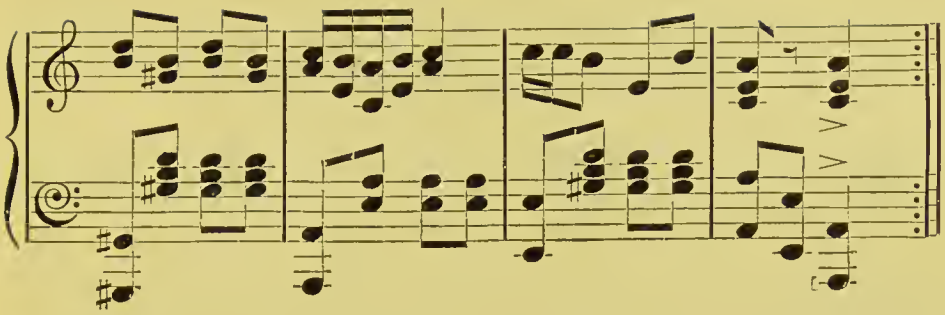




COMBINED MARCHING DRILL.

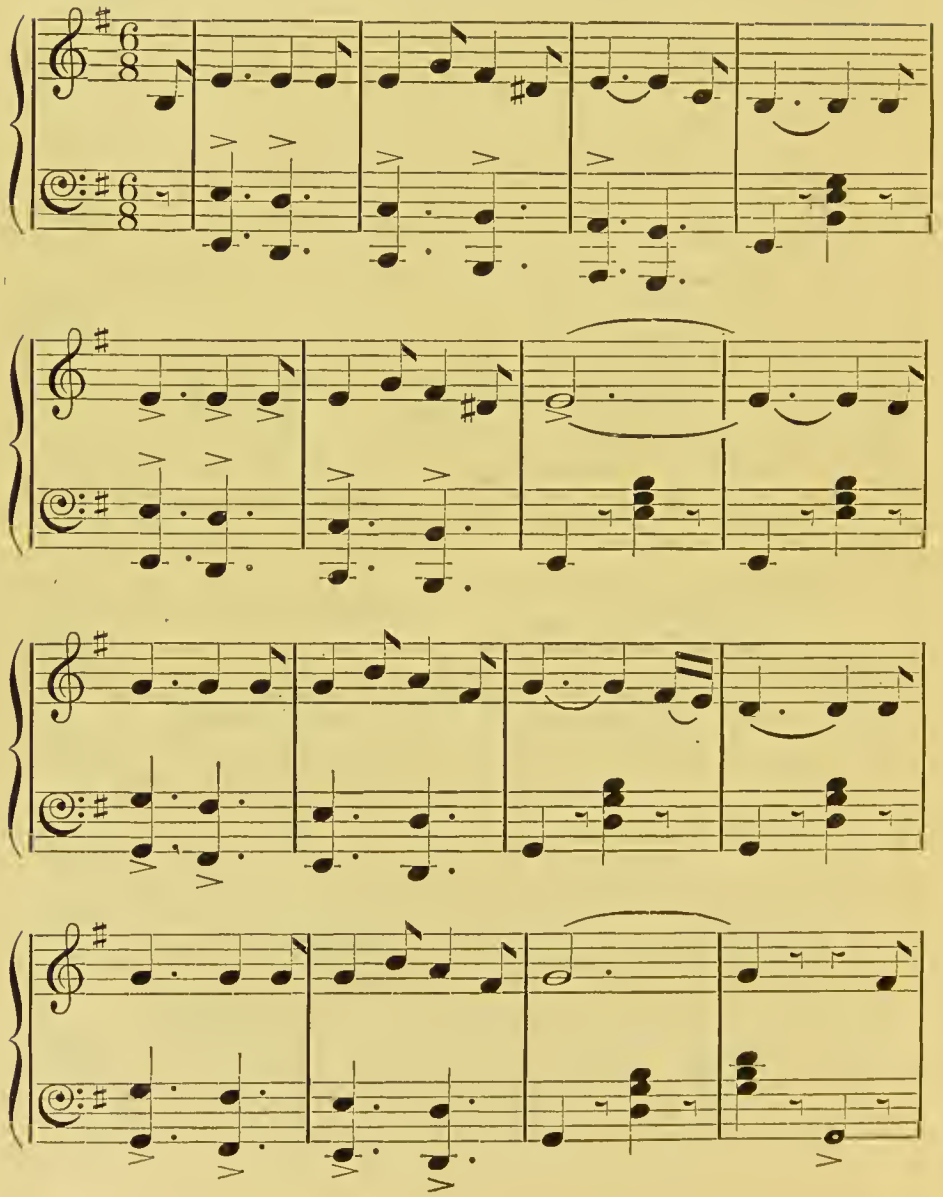
No 7. POLKA MARCH (*vide* p. 103).

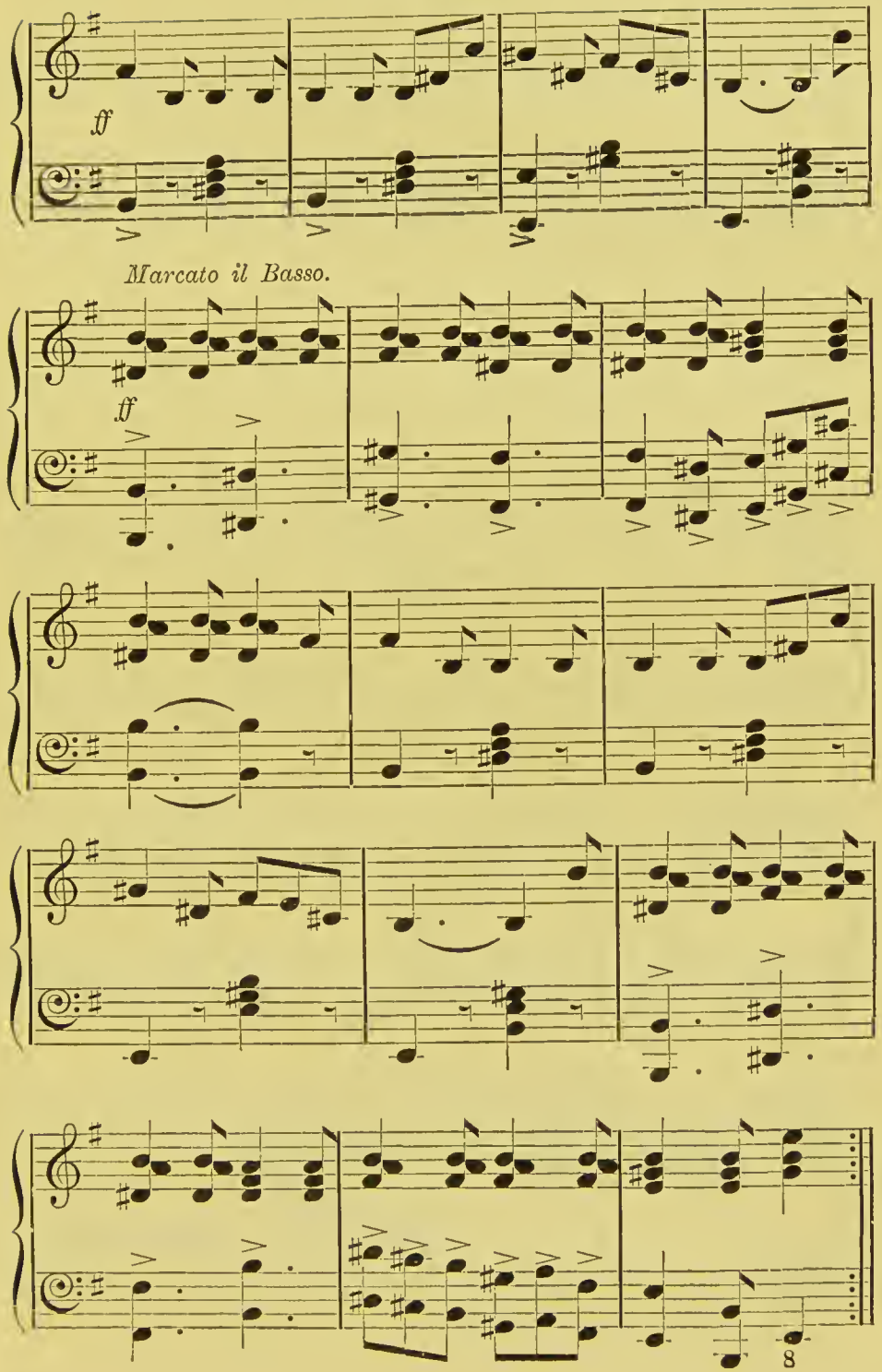




COMBINED MARCHING DRILL.

No. 8. DOUBLE-HOP MARCH (*vide* p. 104).

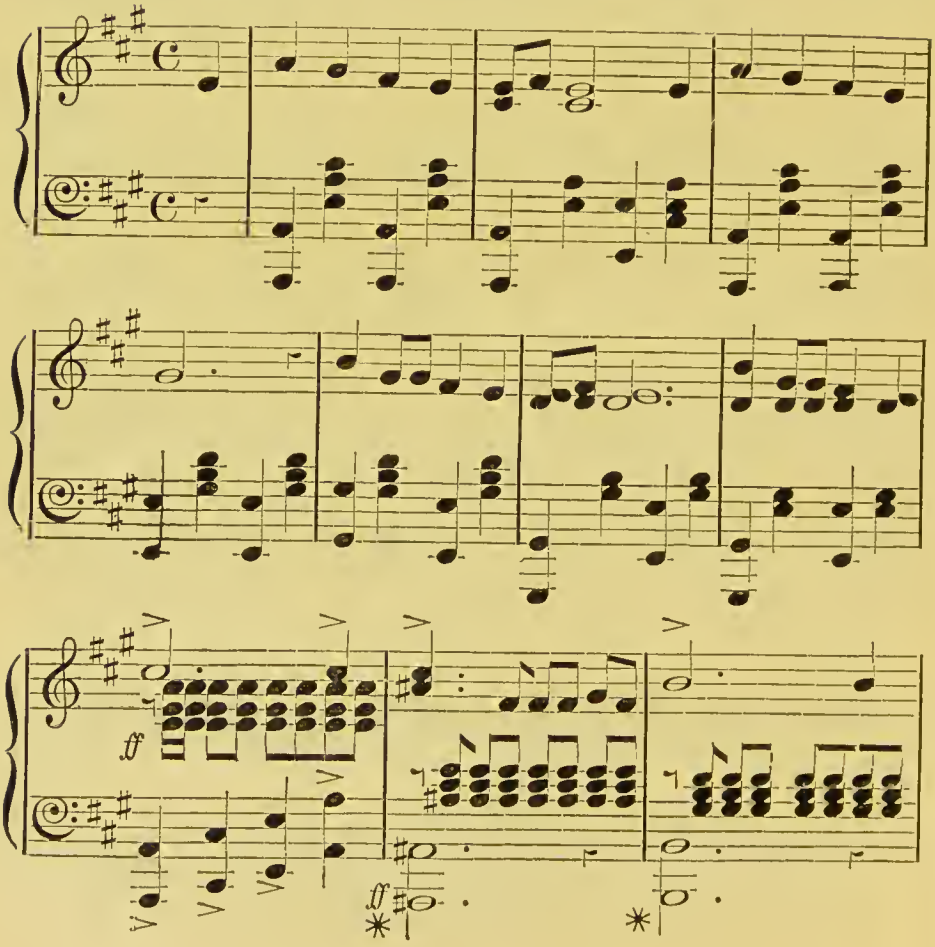


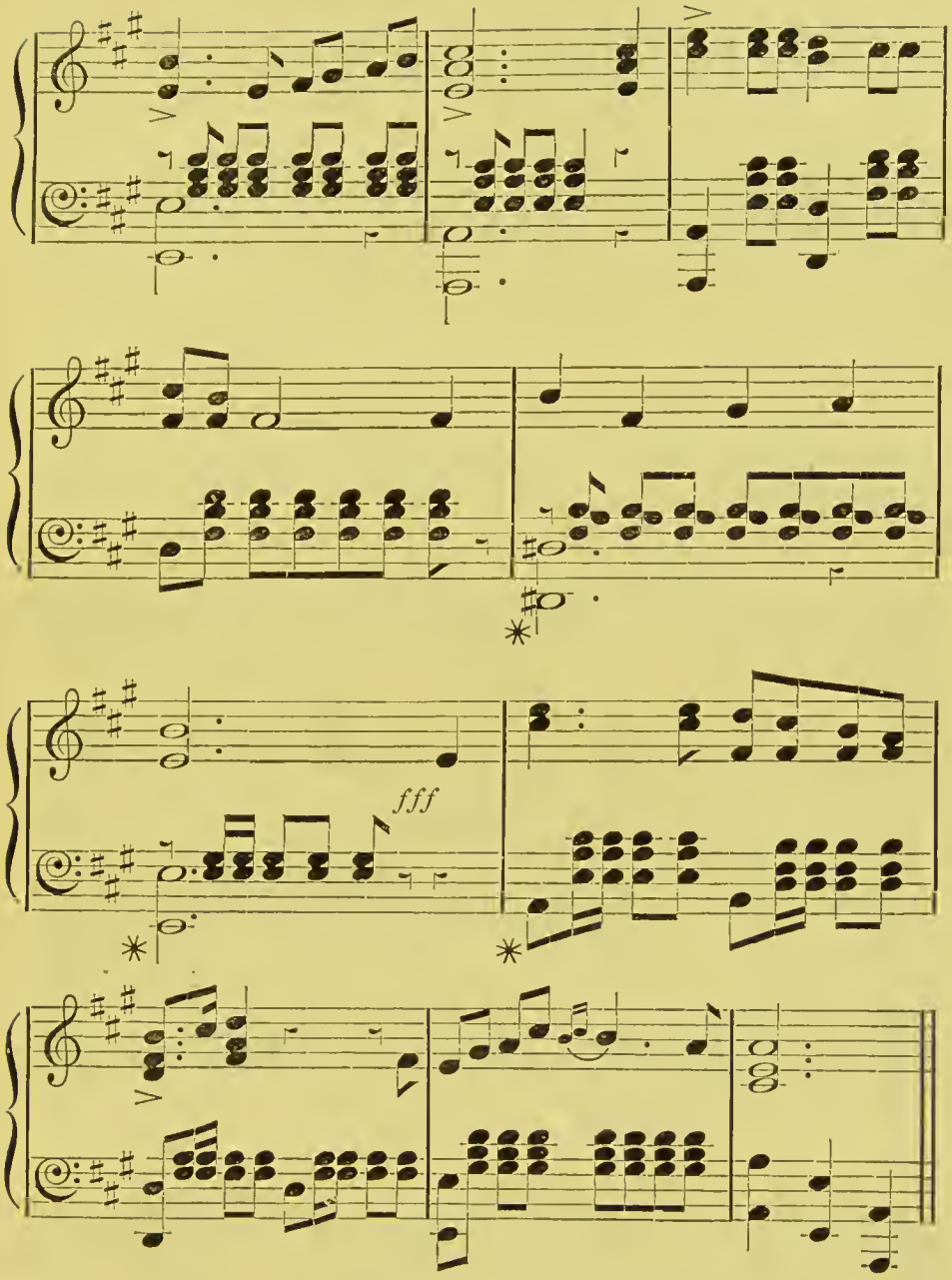

ff
Marcato il Basso.
ff
8

COMBINED MARCHING DRILL.

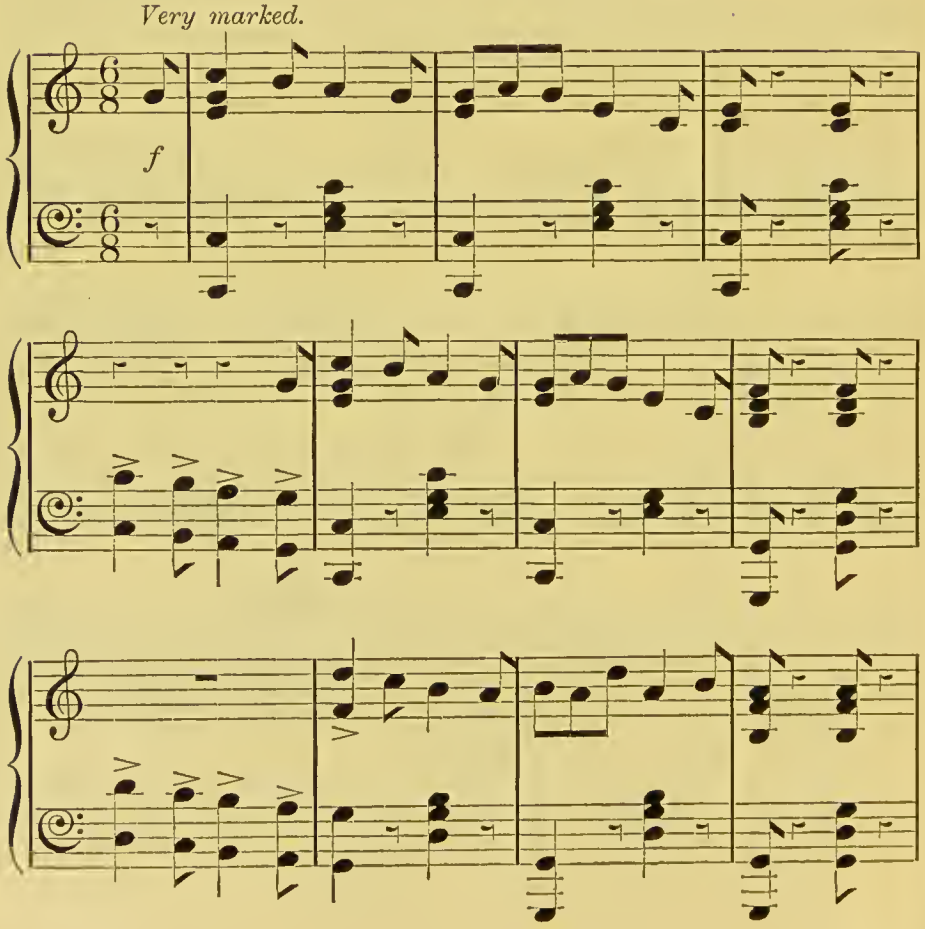
No. 9. FROG MARCH (*vide* p. 105).

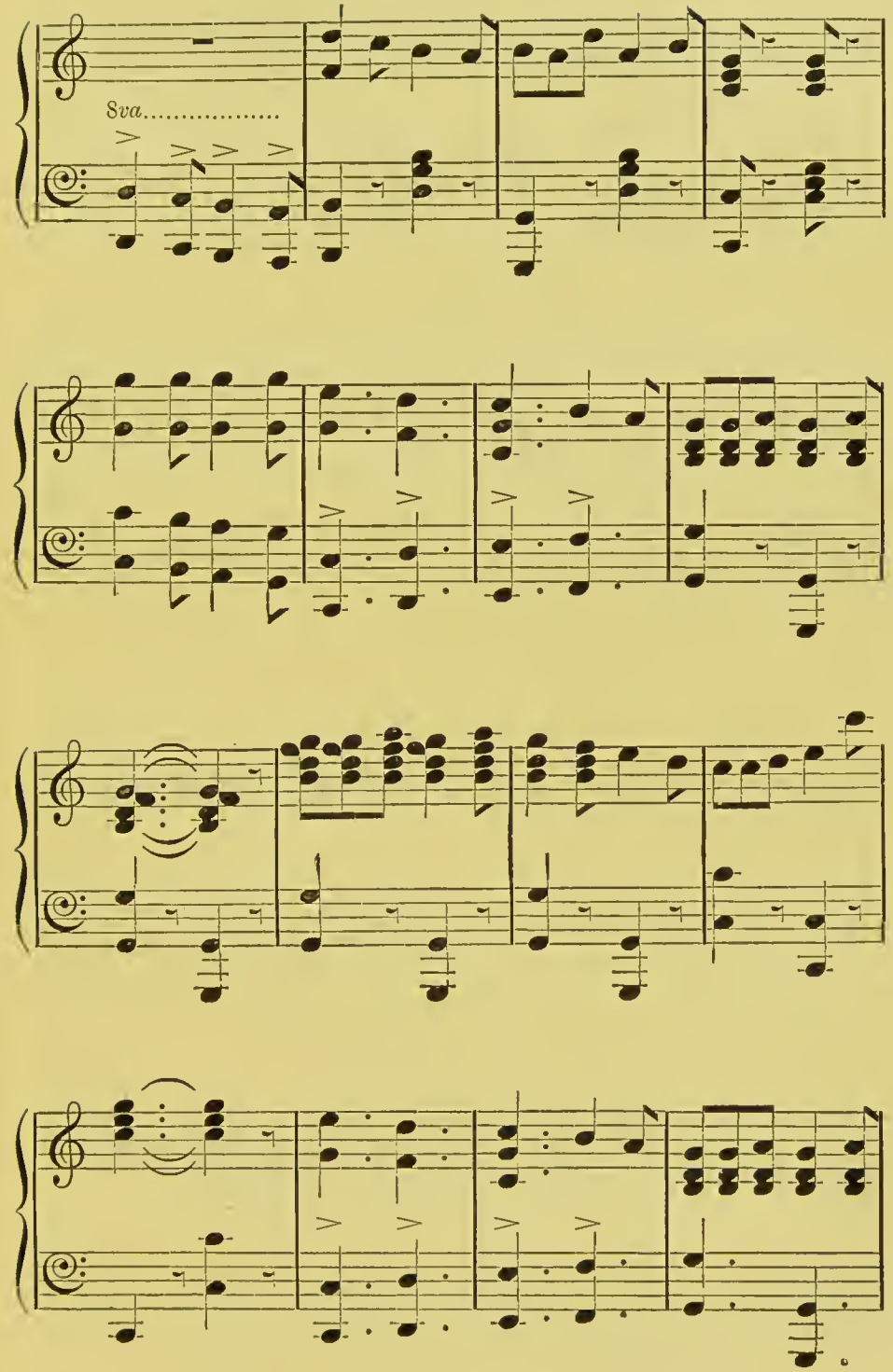
Slow march.

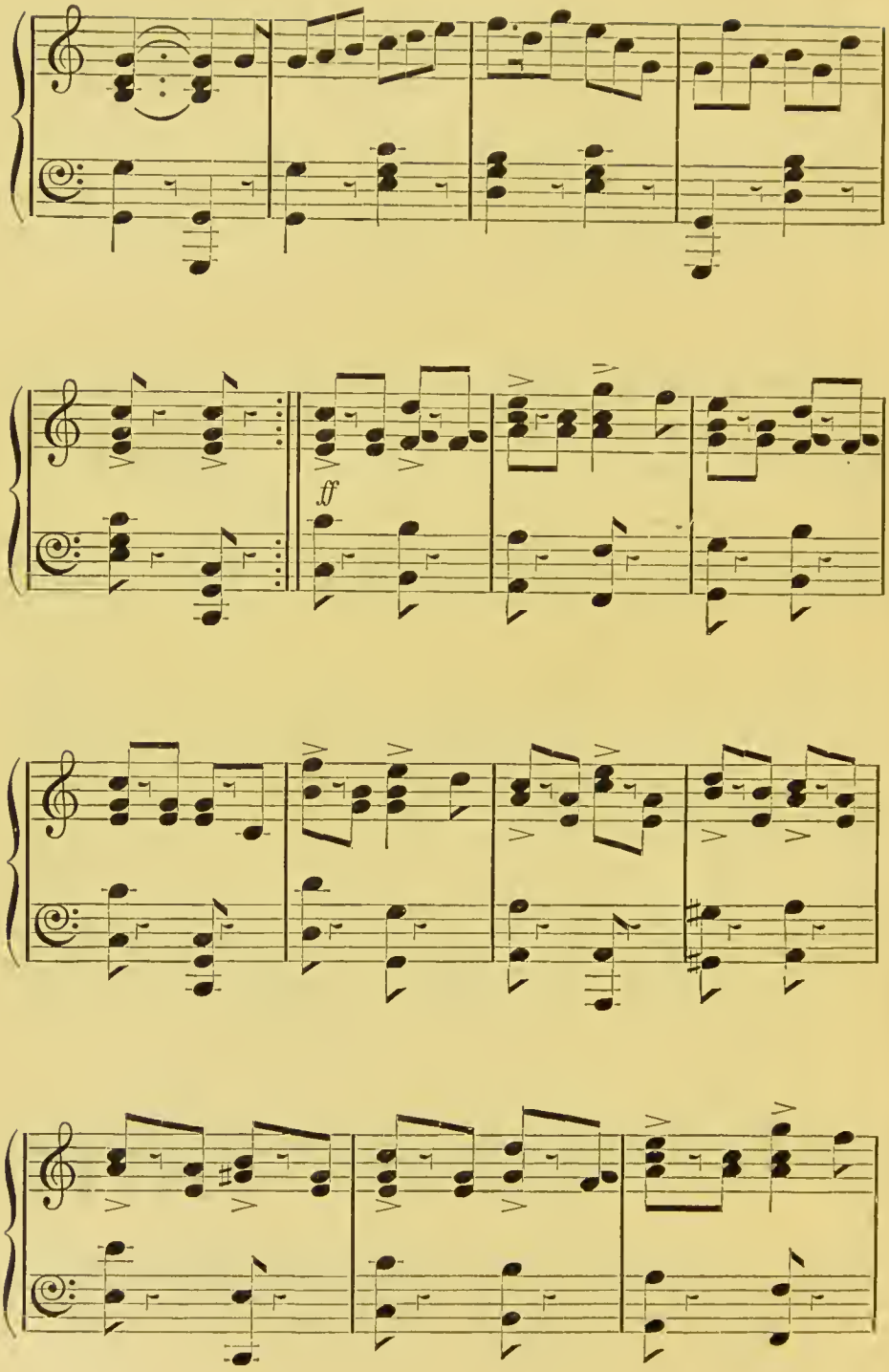



fff

No. 10. FIGURE MARCH (*vide* p. 105).




8va.....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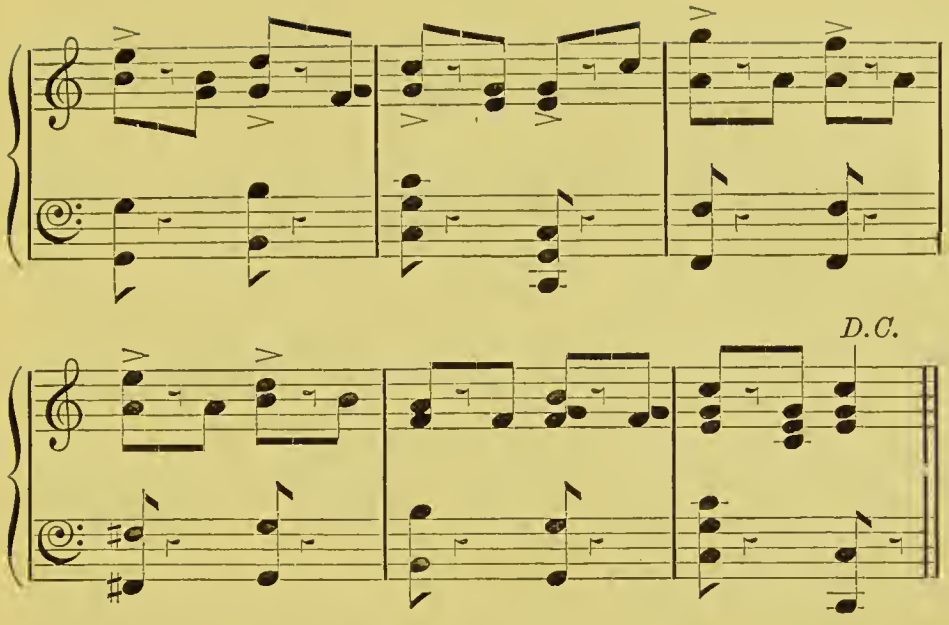
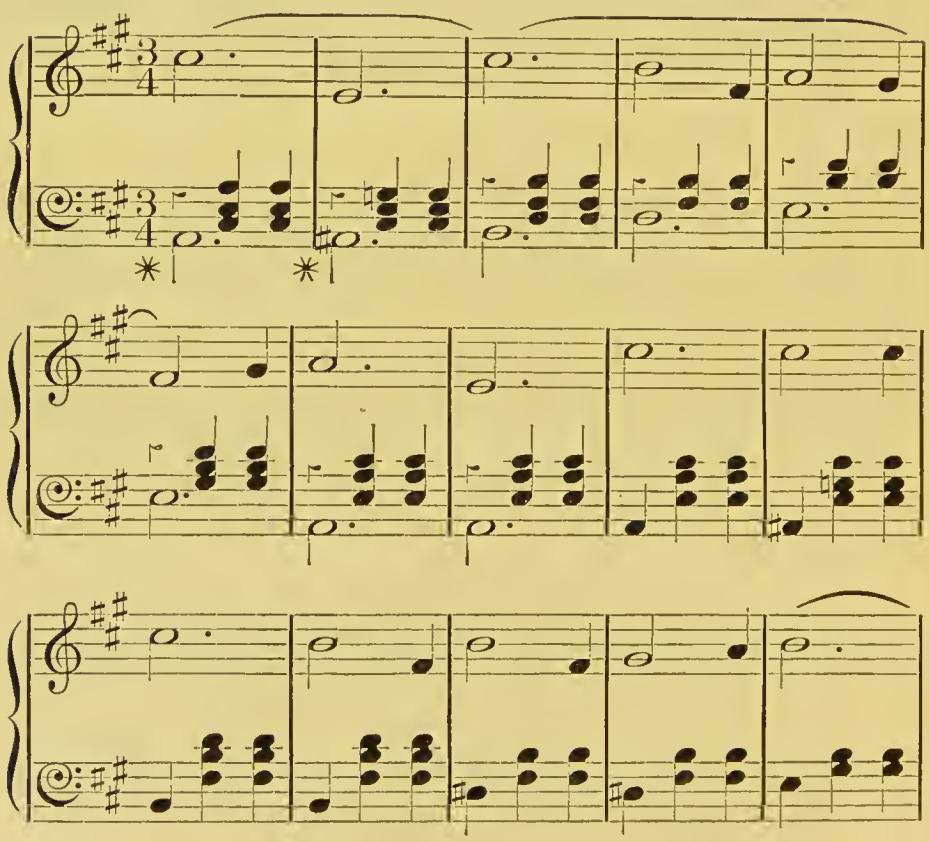
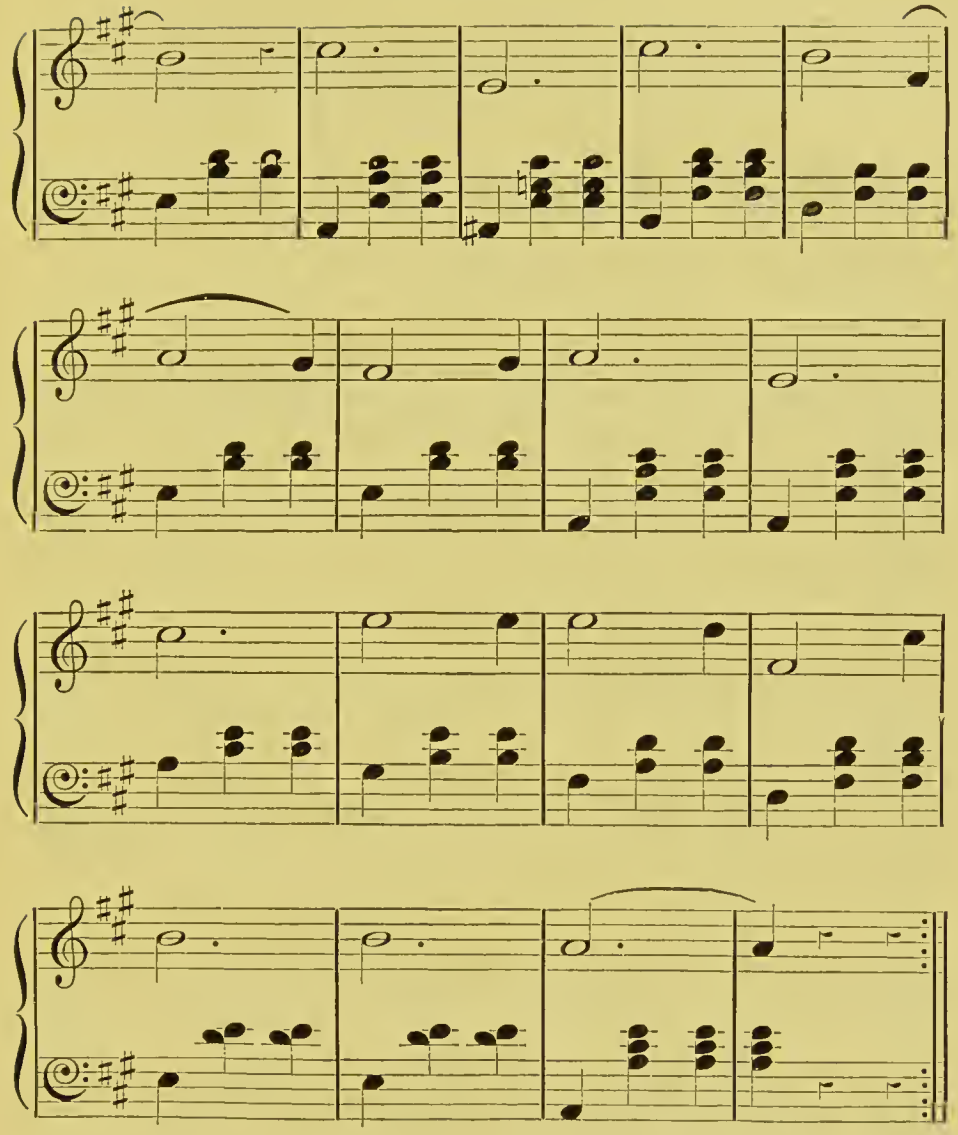

D.C.

No. 11. FREE MOVEMENTS (*vide* p. 110).

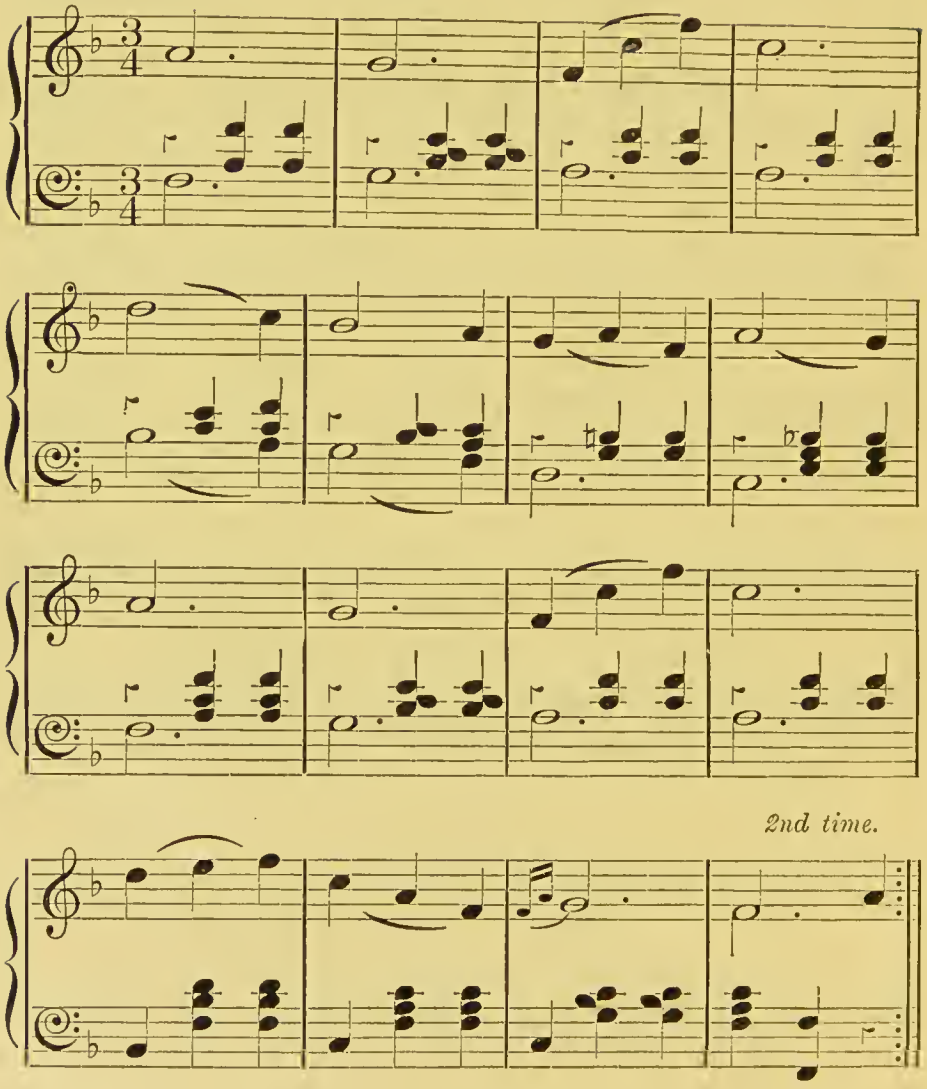
VALSE (for Dumb-bells).

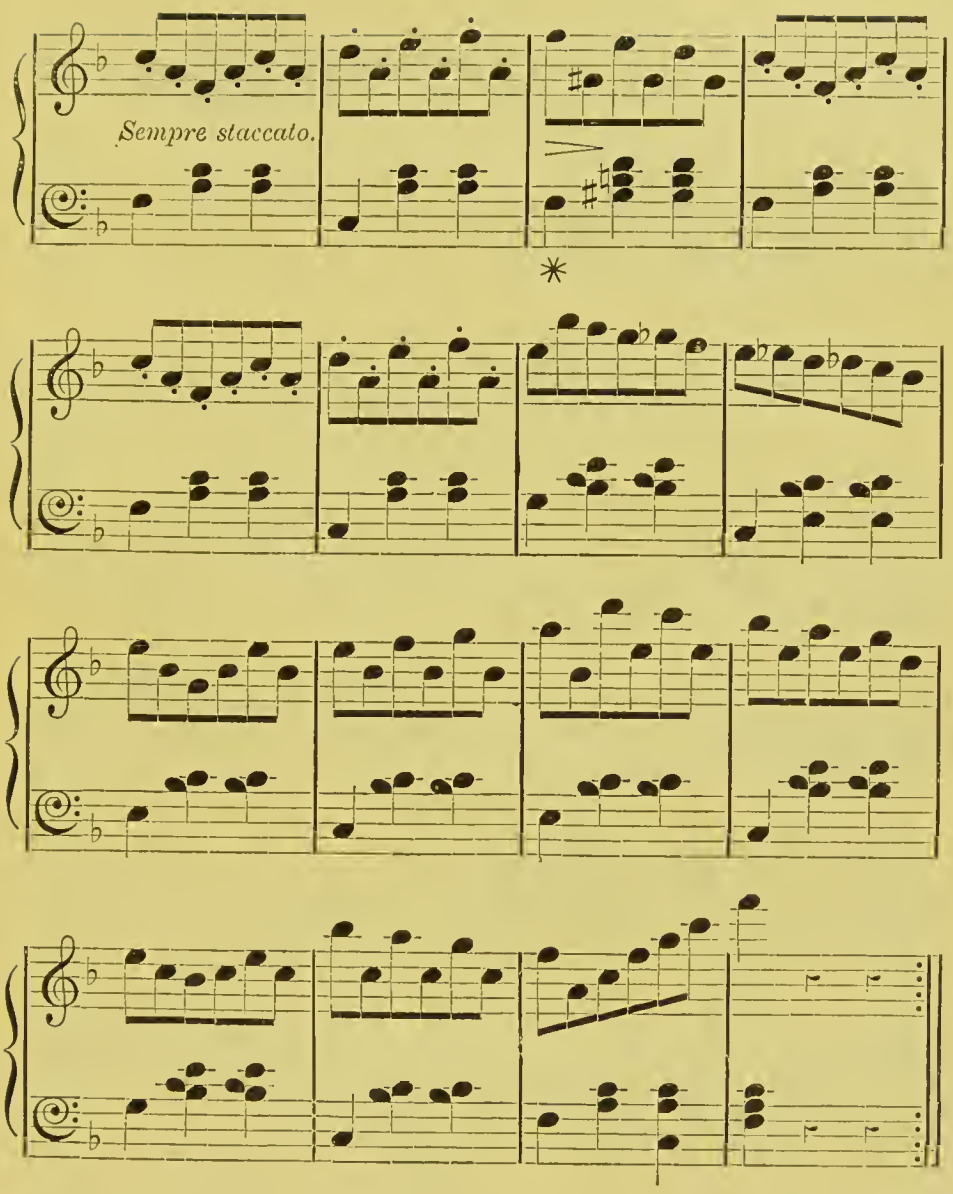




No. 12. CUP MOVEMENTS (*vide* p. 116).

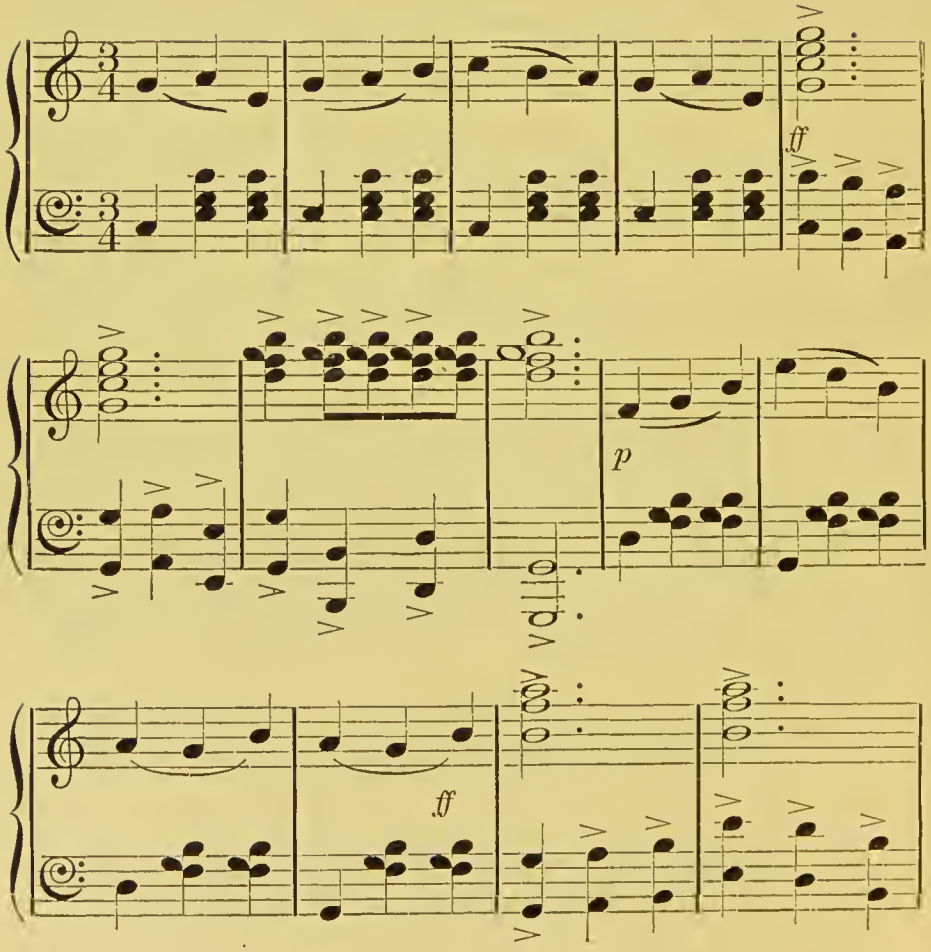
VALSE.

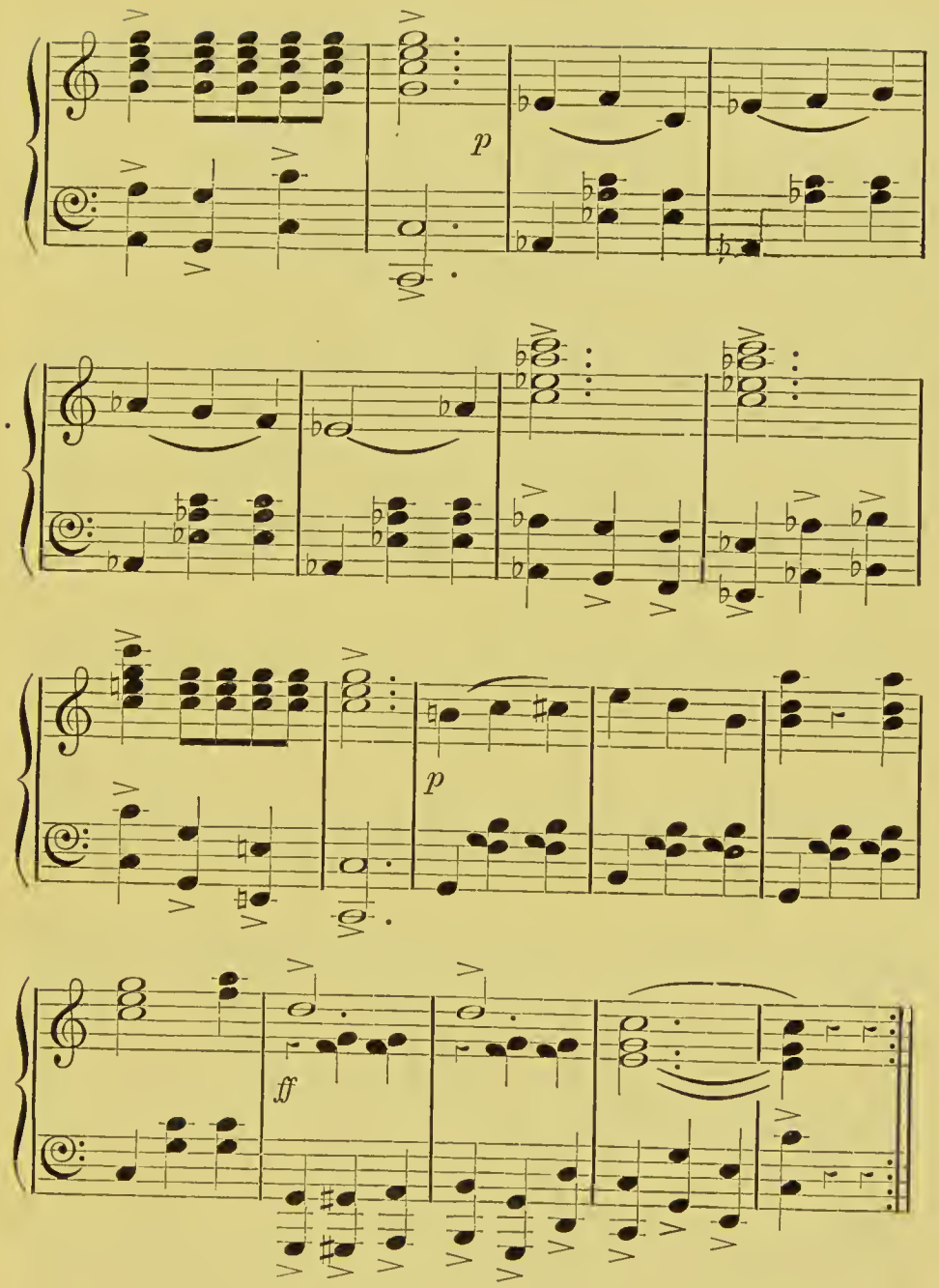



Sempre staccato.

No. 13. WAND EXERCISE (*vide* p. 134).

VALSE.




p
p
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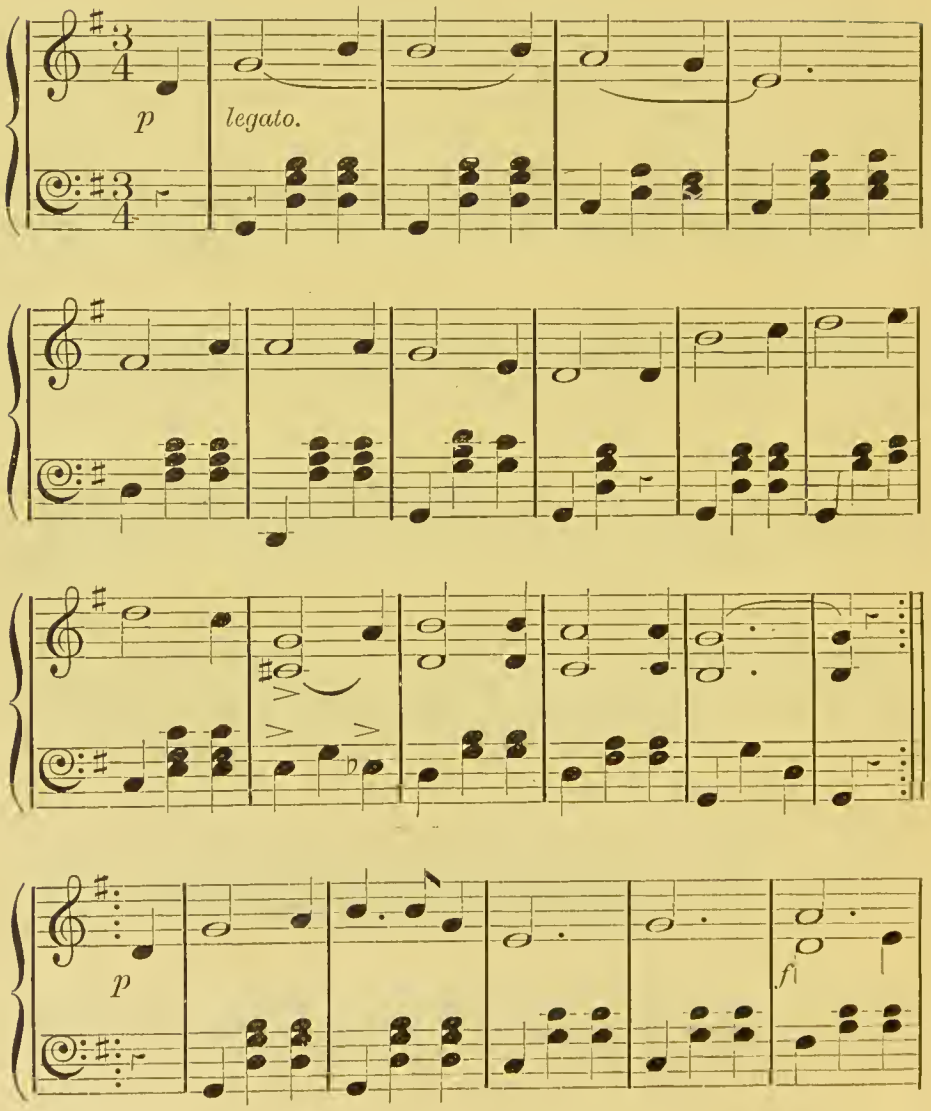
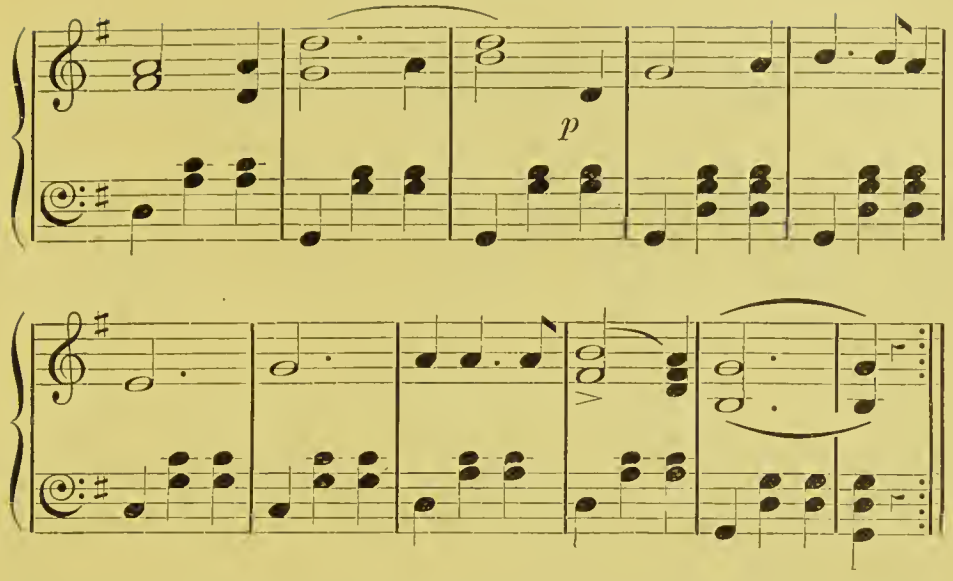
No. 14. BAR-BELL EXERCISE (*vide* p. 140).

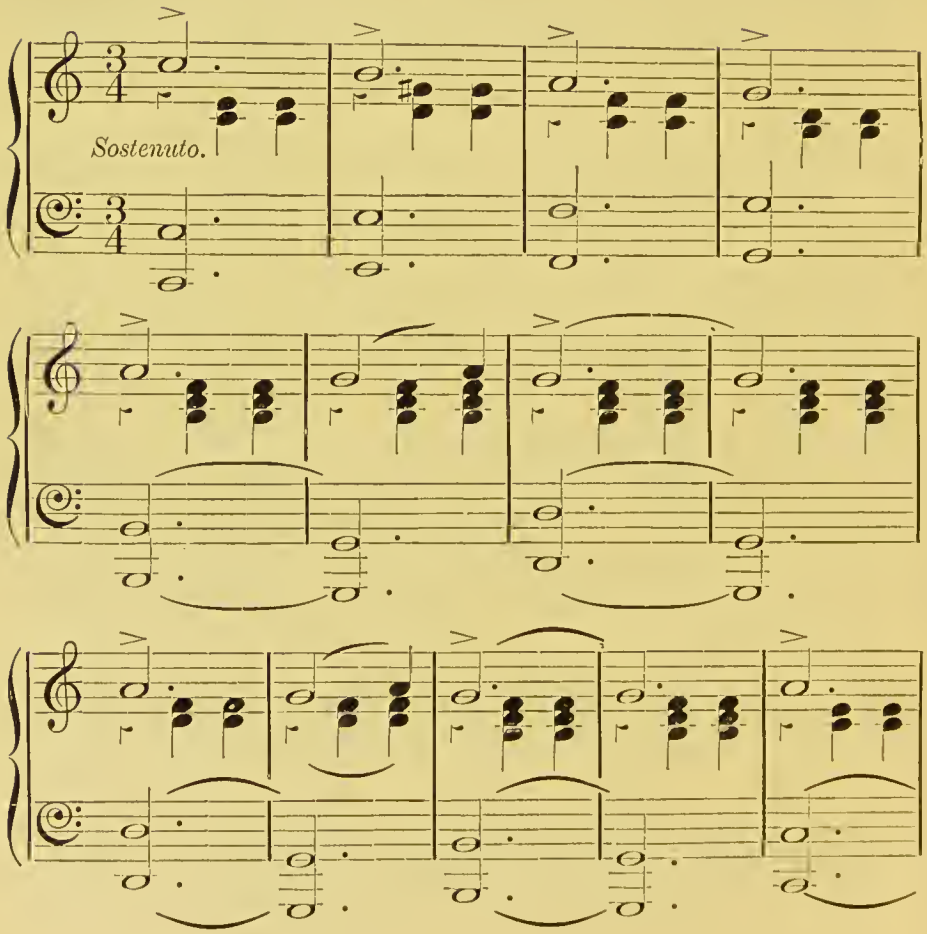
BALL EXERCISE (*vide* p. 172).

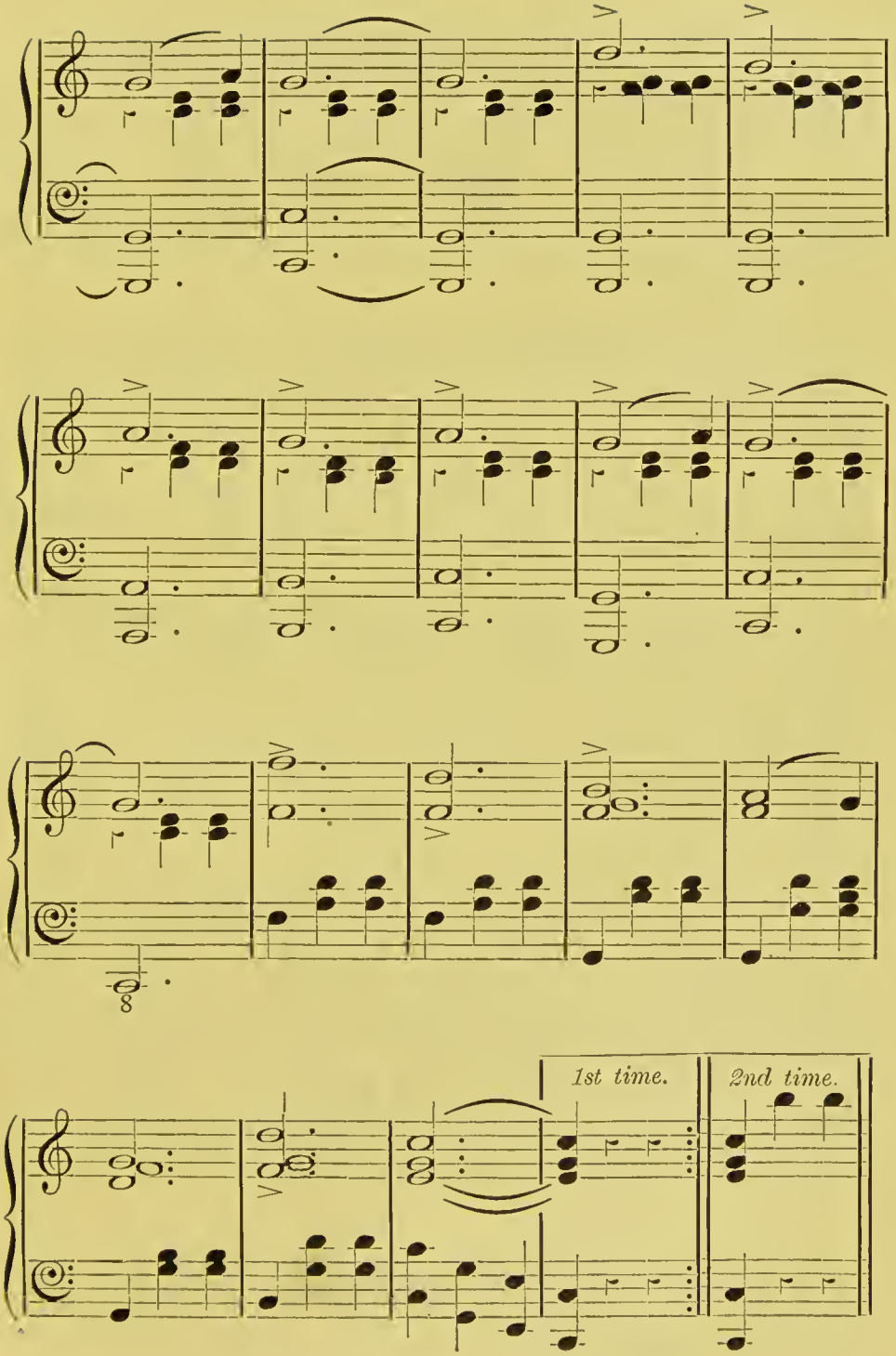


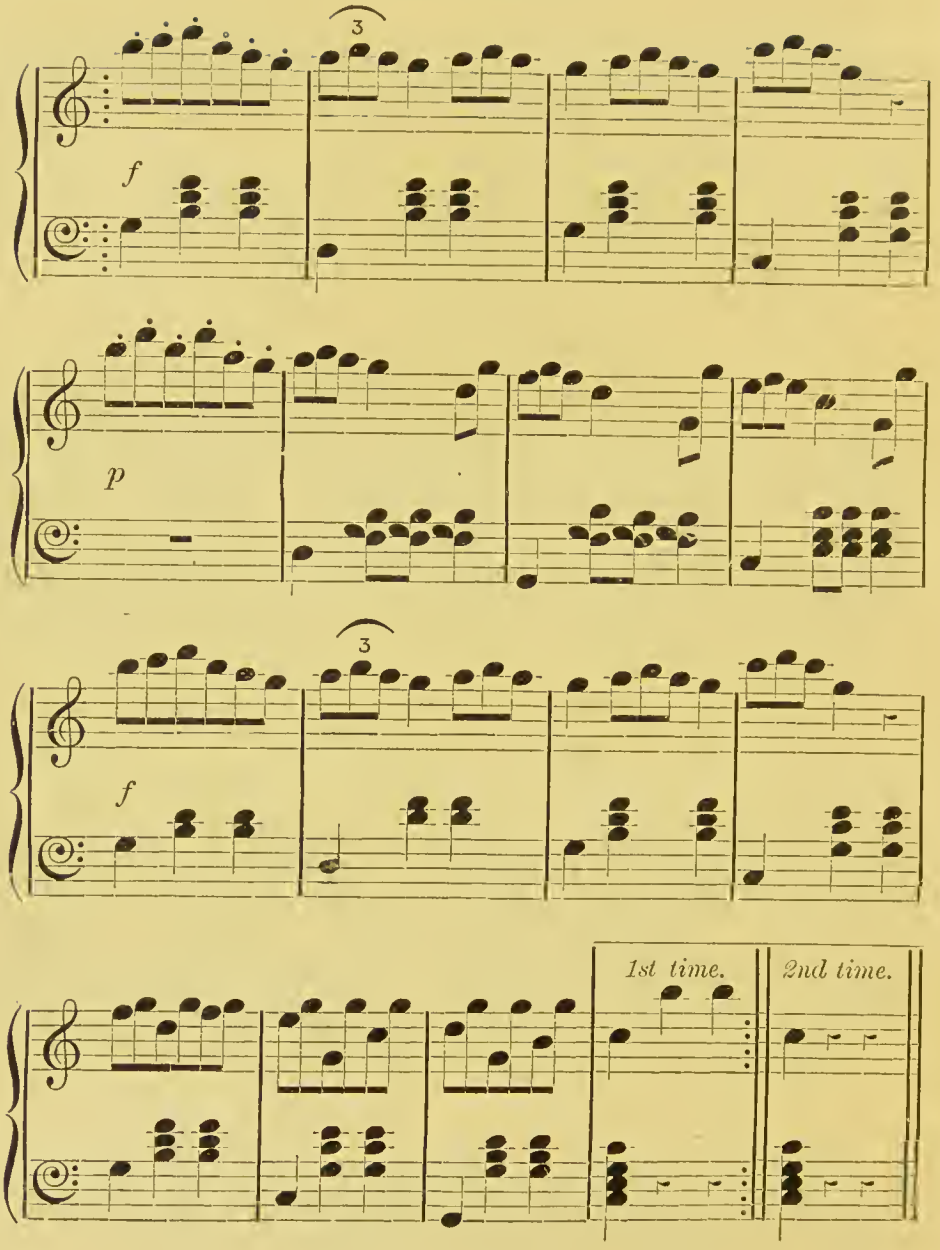

p

No. 15. BAR-BELLS. (Two Pupils.)

(*Vide* p. 157.)




1st time.
2nd time.


3
f
p
3
f
1st time.
2nd time.

No. 16. SKIPPING DRILL (*vide* p. 182).

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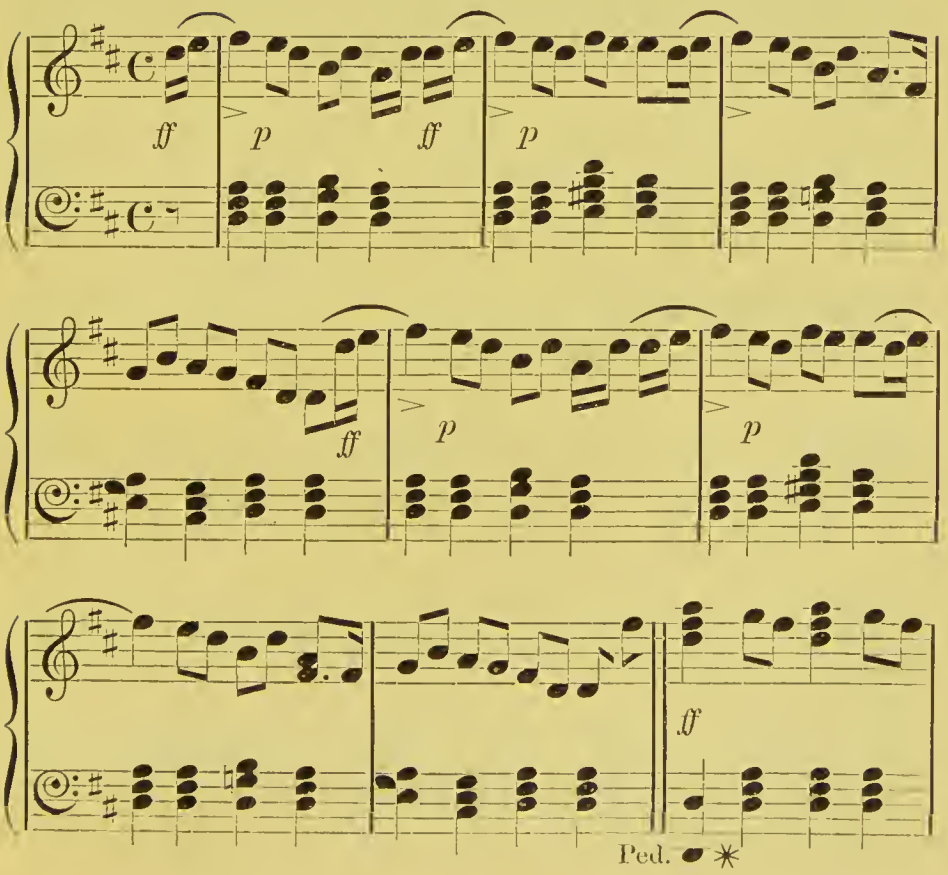

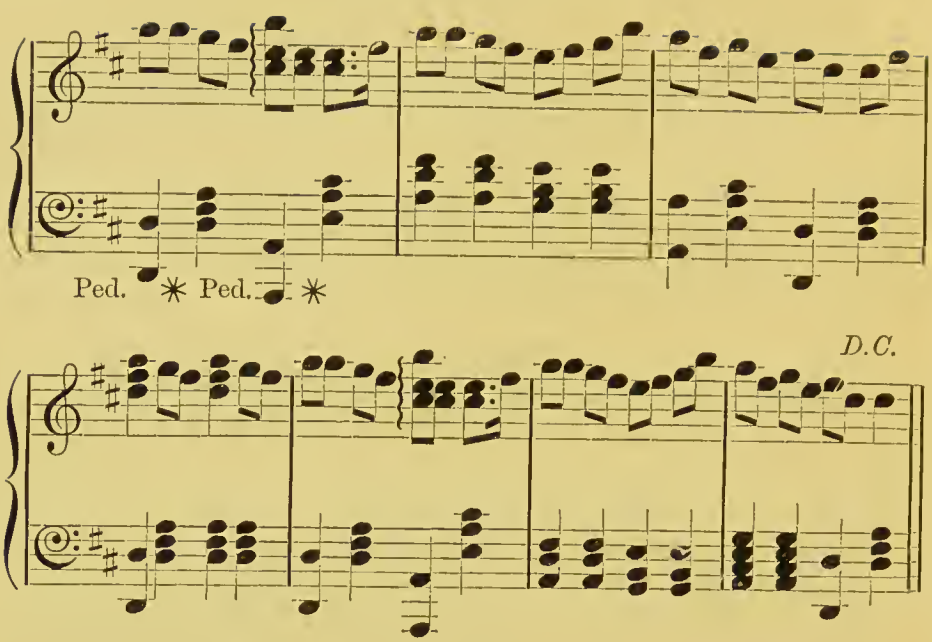
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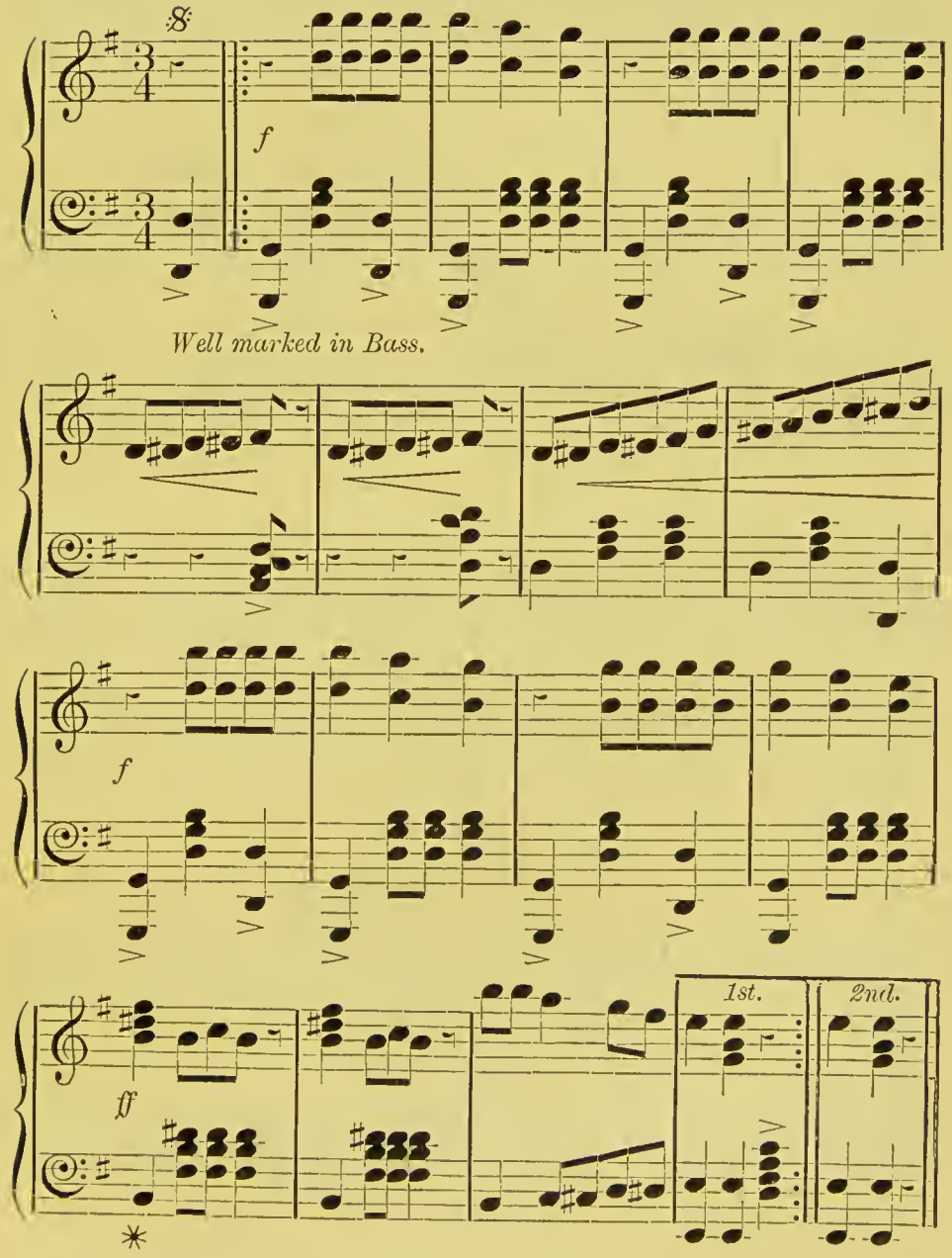

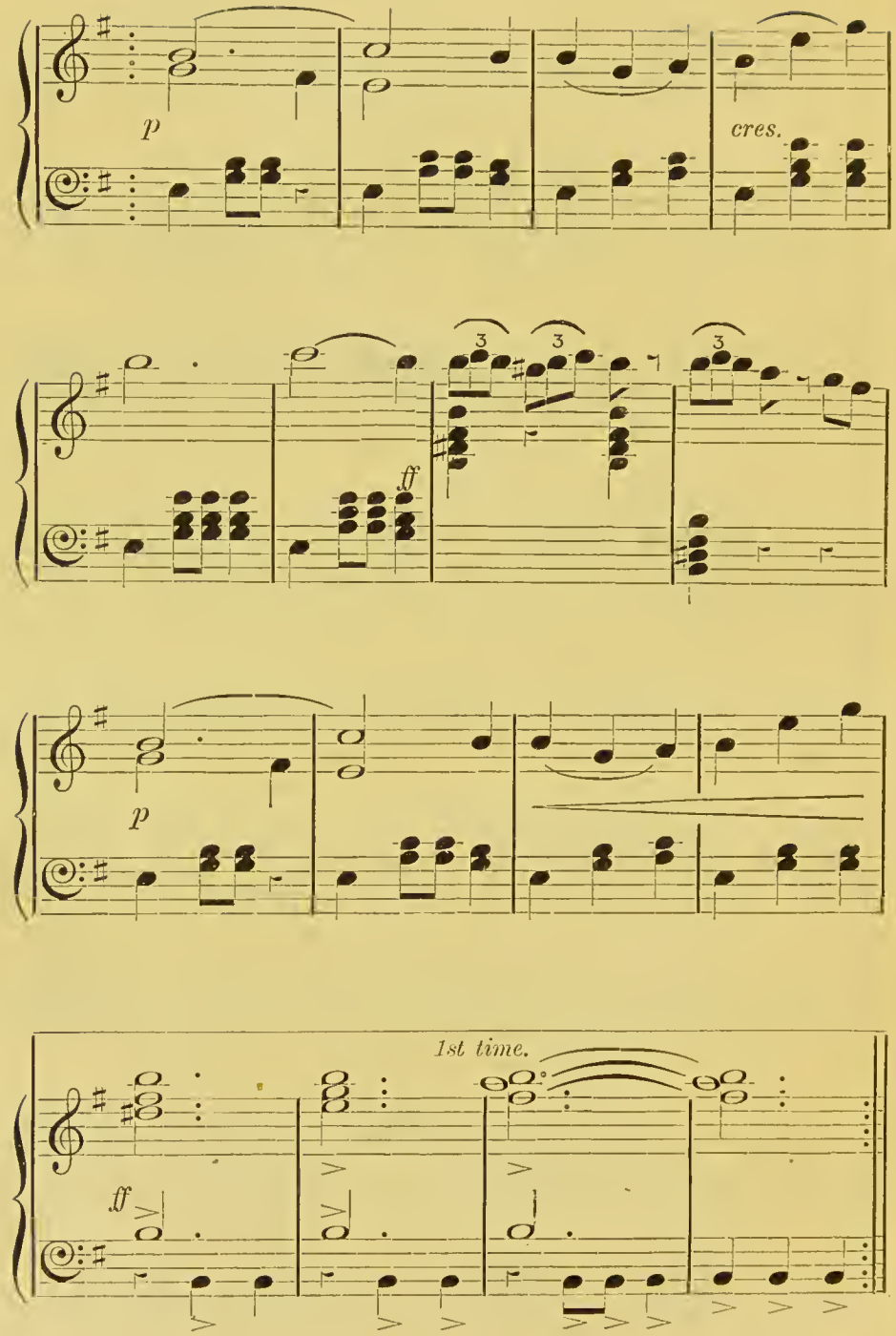
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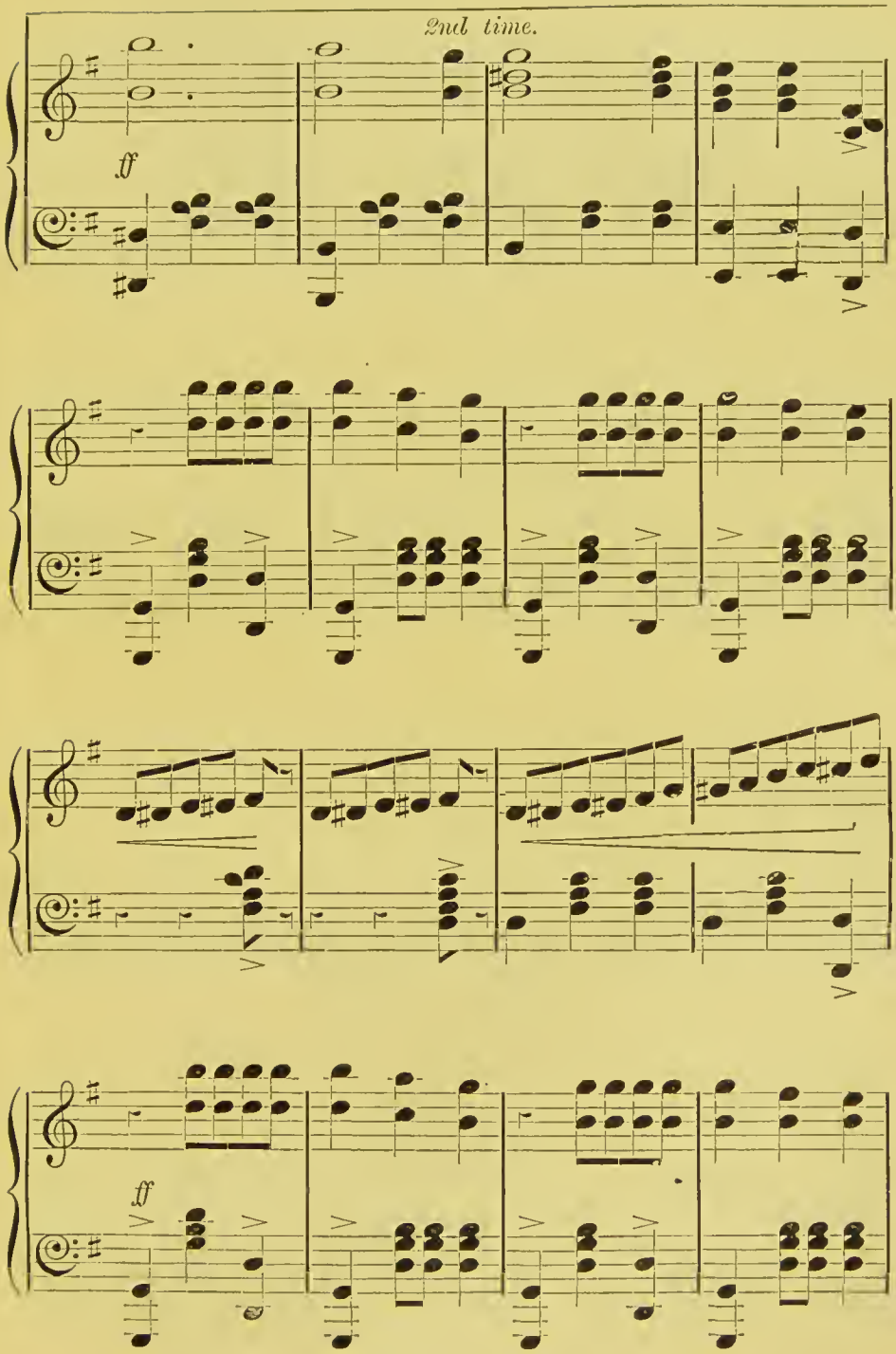
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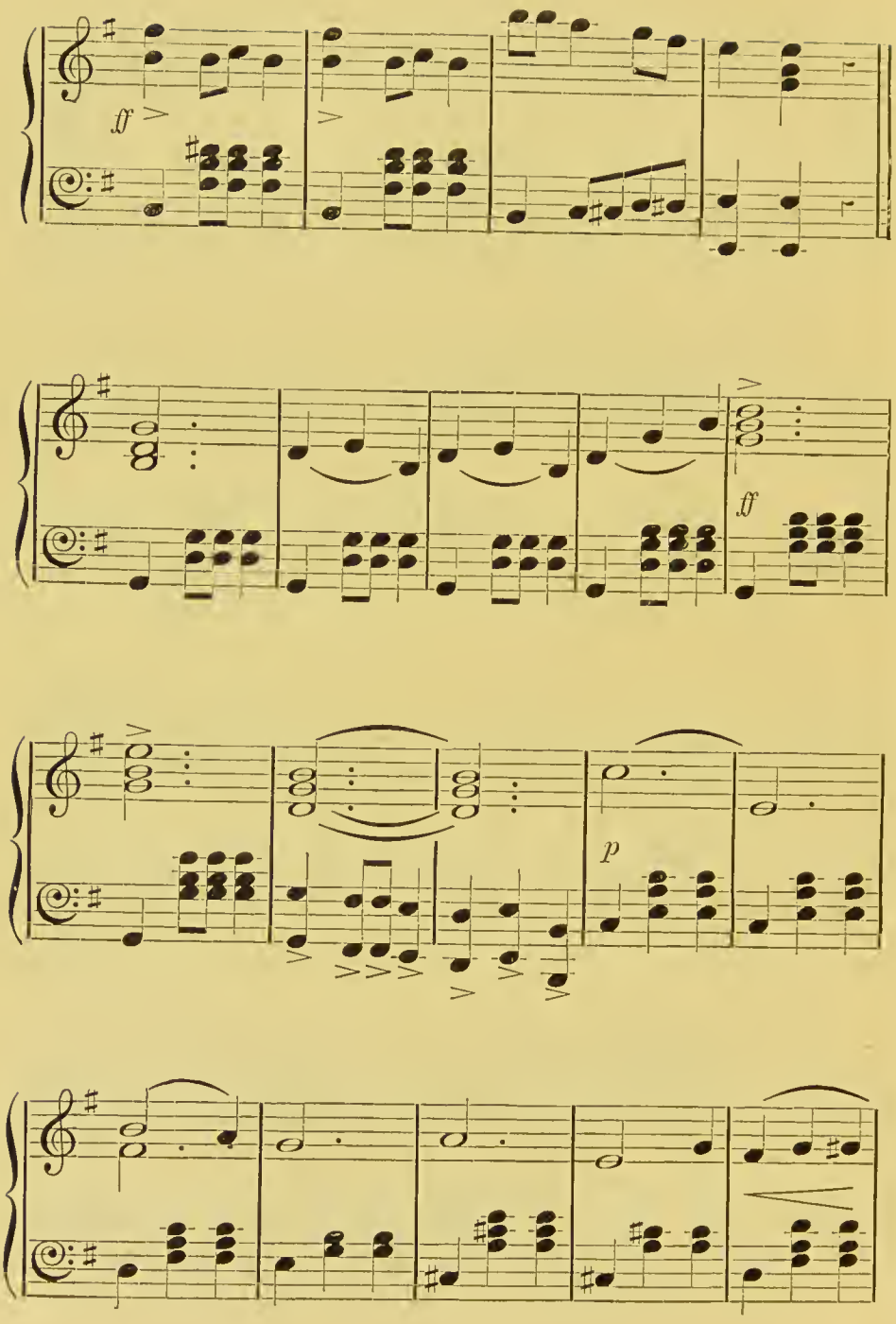
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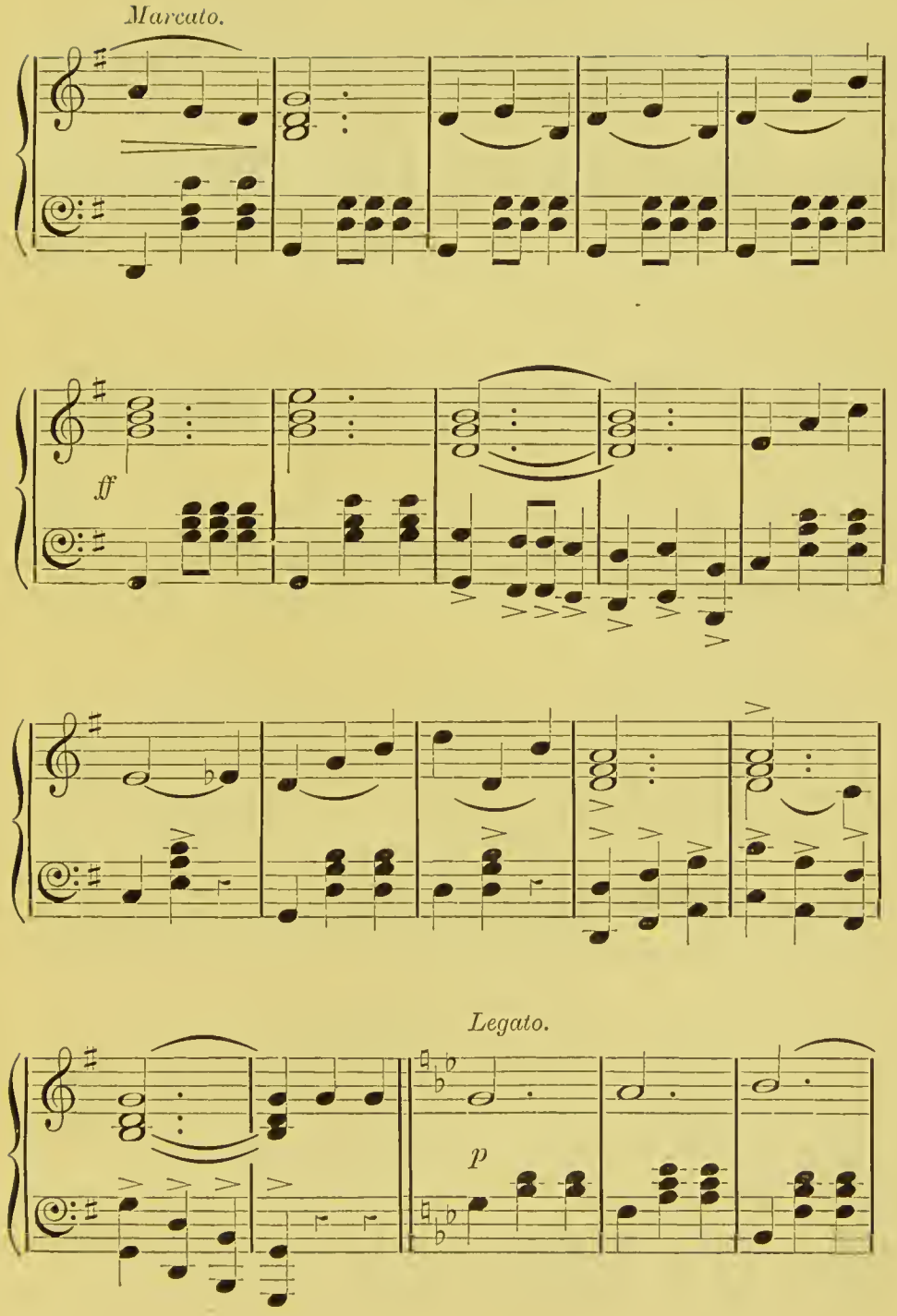
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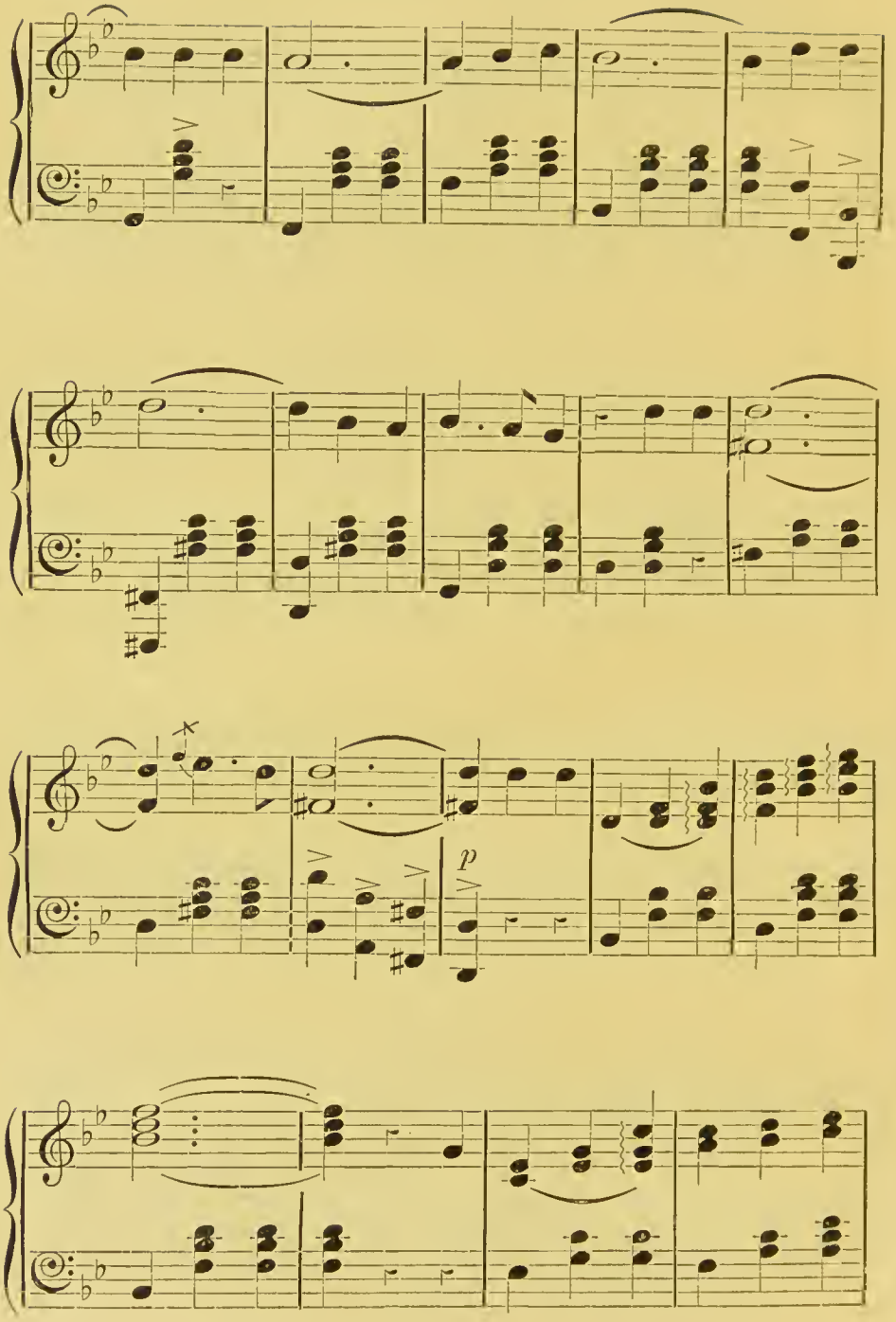
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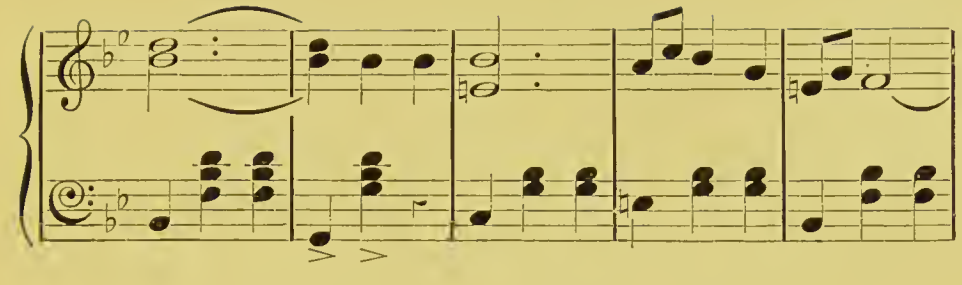

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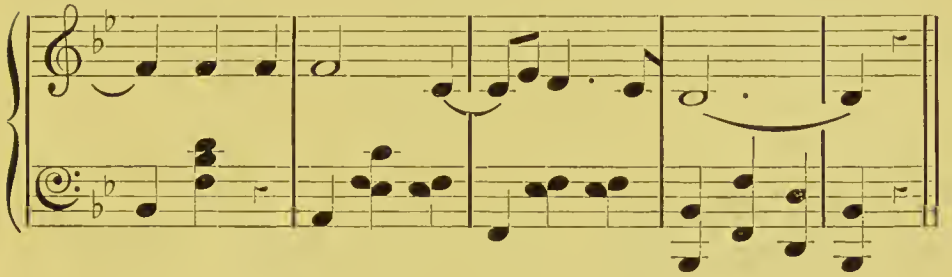

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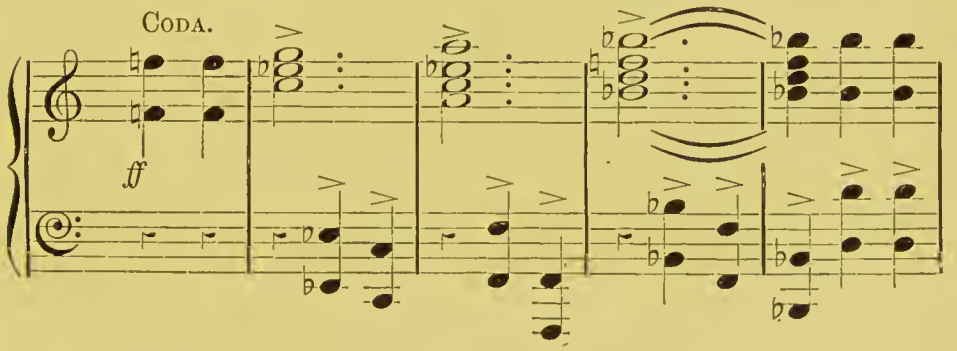

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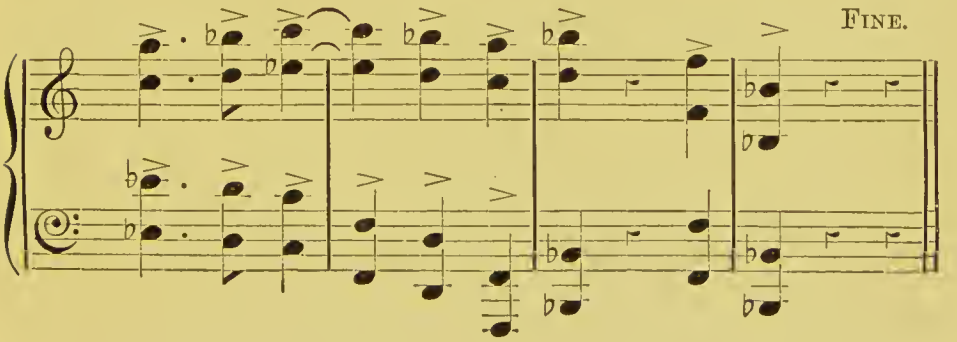

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